



# Hydraulic Pump Drive (HPD) Gearbox

## Section 03-04

Komatsu has made every effort to make this manual as accurate as possible based on the information available at the time of publication and printing. Continuous improvement and advancement of product design may cause changes to machines, which may not have been included in this publication. Komatsu reserves the right to make changes and improvements at any time. To ensure the most current information, please contact your service center.

## Table of Contents

<b>Scope of this Publication, 03-04</b> .....	<b>5</b>
<b>Safety</b> .....	<b>5</b>
Safety, Warnings, and Cautions, 03-04.....	6
<b>Theory of Operation</b> .....	<b>9</b>
Fluid Specifications.....	9
<b>Component Description</b> .....	<b>11</b>
Machines without Remote Fluid Drain and Fill Components .....	11
Machines with Remote Fluid Drain and Fill Components.....	12
Sight Glasses.....	13
<b>Circuit Description for HPD Gearbox Oil</b> .....	<b>19</b>
<b>Removal/Installation Procedures</b> .....	<b>25</b>
HPD Gearbox Removal, Disassembly, and Assembly.....	25
Safety Preparations .....	25
Removal.....	28
HPD Gearbox Disassembly .....	30
Inspection.....	31
Assembly and Shimming for Proper Bearing Endplay.....	33
Installation of Manifold Tube Assembly .....	38
Installation of O-Rings and Spacer O-Ring.....	40
Installation and Alignment of Gearbox to Generator .....	43
Safety Preparations .....	43
Installation.....	46
Completing the Installation.....	47
Alignment and Misalignment.....	51
Component Drawings .....	53
<b>Capscrew and Bolt-Nut Torque Specifications</b> .....	<b>63</b>
Standard SAE G8 and Alloy Steel and Hex Socket Capscrews .....	64
Standard Metric Bolts and Grades (SAE J1701M).....	65
Special Torque Specifications .....	66
Alloy Steel 12PT. Capscrew for Wheel Loader Lift Arm Ballcaps .....	66
Steering Pins (Hex Head Bolt).....	66
Aluminum 12pt. Capscrews used for Motor Pinion Balancing.....	66
2-Thread (2-Start) Steel 12PT. Capscrews .....	66
Bolt and Capscrew Markings on Head .....	66
Key Items .....	67

# List of Figures

Figure 1.	Remote Drain and Fill locations on HPD (optional).....	13
Figure 2.	Sight glass with “high” (full) and “low” level indicator marks (glass shown empty).....	13
Figure 3.	L-1350 hydraulic pump arrangement (typical pump types are illustrated).....	15
Figure 4.	L-1850 hydraulic pump arrangement (typical pump types are illustrated).....	16
Figure 5.	L-2350 hydraulic pump arrangement (typical pump types are illustrated).....	17
Figure 6.	Hydraulic pump drive (HPD) oil manifold (typical) location.....	20
Figure 7.	Hydraulic pump drive (HPD) oil manifold orifices.....	20
Figure 8.	Hydraulic pump drive (HPD) internal oil circulation.....	20
Figure 9.	HPD gearbox oil cooler circuit components (typical).....	22
Figure 10.	Hydraulic pump drive (HPD) oil cooler circuit (typical).....	23
Figure 11.	Frame Lock.....	25
Figure 12.	Battery Isolation Box – Battery isolation switch in OFF position with locks in place.....	26
Figure 13.	Hydraulic reservoir air valve handle UP.....	26
Figure 14.	Open air reservoir bleed valves.....	27
Figure 15.	Pressure bleed down valves.....	27
Figure 16.	Hoisting of hood assembly.....	28
Figure 17.	Hoisting of KLENZ™ and blower assembly.....	29
Figure 18.	KLENZ™ and blower assembly supported by cribbing - 1 of 3.....	29
Figure 19.	KLENZ™ and blower assembly supported by cribbing - 2 of 3.....	29
Figure 20.	KLENZ™ and blower assembly supported by cribbing - 3 of 3.....	30
Figure 21.	Holes in gearbox must have the surrounding O-ring grooves welded up and machined smooth.....	31
Figure 22.	Three .020 shims to be installed to rear output bearing housing.....	33
Figure 23.	Installation of shims (.060) to rear output bearing housings.....	33
Figure 24.	Installation of O-ring to rear output bearing housing.....	33
Figure 25.	Application of assembly grease to gearbox.....	34
Figure 26.	Installation of rear output bearing housing.....	34
Figure 27.	Installation of front output bearing housing with .040 shims in place.....	35
Figure 28.	Installation of brace bars.....	36
Figure 29.	Magnetic base dial indicator in position to read bearing end play.....	36
Figure 30.	Gear pried toward rear of gearbox.....	36
Figure 31.	Gear pried toward rear of gearbox to measure bearing end play.....	37
Figure 32.	Removal of front output bearing housing for shim adjustment.....	37
Figure 33.	Incorrect manifold tube assembly with straight tubes.....	38
Figure 34.	Correct manifold tube assembly with curved tubes.....	38
Figure 35.	Correct hose installation to manifold tube assembly to avoid damaging hose.....	39
Figure 36.	Side view illustration of sleeve installation with spacer O-ring.....	40
Figure 37.	Installation of spacer O-ring into output bearing housing.....	40
Figure 38.	Completed installation of spacer O-ring.....	40
Figure 39.	Application of assembly grease to sleeve O-ring and sleeve.....	41
Figure 40.	Placement of sleeve square into output bearing housing.....	41
Figure 41.	Installation of sleeve into output bearing housing.....	41
Figure 42.	Application of assembly grease to pump O-ring and pump.....	42
Figure 43.	Installation of pump to gearbox.....	42
Figure 44.	Installation of pumps retaining bolts & flat washers.....	42
Figure 45.	Frame Lock.....	43
Figure 46.	Battery Isolation Box – Battery isolation switch in OFF position with locks in place.....	44
Figure 47.	Hydraulic reservoir air valve handle UP.....	44
Figure 48.	Open air reservoir bleed valves.....	45
Figure 49.	Pressure bleed down valves.....	45
Figure 50.	L1350/L1850/L2350 HPD gearbox drive shaft installation.....	48
Figure 51.	HPD gearbox alignment.....	49
Figure 52.	Generator insulated components.....	49
Figure 53.	Installed components cross section.....	50
Figure 54.	HPD and generator shafts aligned properly.....	51
Figure 55.	Vertical misalignment.....	51
Figure 56.	Vertical misalignment with generator and gearbox not parallel.....	52

Figure 57. Vertical and horizontal misalignment with generator and gearbox not parallel ..... 52  
 Figure 58. HPD gearbox and pumps 1350 GEN3 ..... 53  
 Figure 59. HPD gearbox and pumps Tier I (typical) ..... 54  
 Figure 60. HPD gearbox and pumps Tier II (typical) ..... 55  
 Figure 61. HPD gearbox and pumps L2350 (typical)..... 56  
 Figure 62. HPD gearbox assembly L1350/L1850/L2350 (typical) ..... 57  
 Figure 63. HPD mounted air compressor L1350/L1850/L2350 (typical) ..... 59  
 Figure 64. HPD assembly view L1350/L1850/L2350 (typical)..... 60  
 Figure 65. HPD and drive adapters L1850/L2350 (typical) ..... 61

## List of Tables

Table 1. HPD gearbox fluid specifications ..... 9  
 Table 2. HPD gearbox components (typical)..... 11  
 Table 3. HPD gearbox components with remote fluid drain and fill fittings (typical) ..... 12  
 Table 4. Typical weights for components ..... 28

This Page Intentionally Left Blank

# Scope of this Publication, 03-04

HPD Gearbox provides information on the gearbox lubricant, pump and circuit, and overhauling the HPD gearbox assembly.

## Safety

This publication contains special instructions that pertain to safety, operation, maintenance, and repair of the machine. Listed below are the signal words and symbols that precede these instructions and their meanings:


### DANGER

- The danger label indicates a hazardous situation which, if not avoided, will result in death or serious injury.

### WARNING

- The warning label indicates a hazardous situation which, if not avoided, could result in death or serious injury.

### CAUTION

- The caution label, used with the safety alert symbol indicates a hazardous situation which, if not avoided, could result in minor or moderate injury (includes the safety alert symbol .

### CAUTION

- The caution label (without safety alert symbol) is used to address practices not related to personal injury – only equipment damage.

### NOTICE

The NOTICE graphic is to indicate areas of importance to the reader that are not related to personal injury or machine damage.

## Safety, Warnings, and Cautions, 03-04

### **WARNING**

#### CRUSH HAZARD

- Crush hazards exist if the machine is started or moved while work processes are being performed on the machine. Place bucket flat and level on the ground. Place frame lock in the locked position and lock out the machine's starting capability before performing any work process. Follow all applicable lockout procedures and local rules and regulations for performing work processes. ANYONE performing inspections or service procedures to the machine should be familiar with ALL instructions and procedures contained in the machine's SERVICE MANUAL. Crush hazard could occur if the machine is started or moves while any type of work process is being conducted on the machine, resulting in serious injury or death.
- Crush hazards exist if all personnel are not cleared from the bucket and lift arm area before using the hydraulic hoist and bucket hydraulic pressure bleed down valves to relieve pressure from the hoist and bucket circuit. Clear all personnel from the area around the bucket and lift arms before operating hydraulic hoist and bucket hydraulic pressure bleed down valves. Using the hydraulic bleed down valves could result in some movement of the lift arms and bucket which could cause a crush hazard resulting serious injury or death.
- Crush hazards exist in machine pivot area and area between the tires. Do not enter these areas unless it is verified that the operator has control over the steering and that personnel locking the frame lock have good communication with the operator. Entering the pivot area and area between the tires while the machine is moving or pivoting (articulating) could cause crush hazards resulting in serious injury or death.

#### CRUSH, SHOCK, OR OTHER HAZARDS

- Crush, shock, or other hazards exist if stored energy is not removed or isolated prior to working on the machine. Stored energy (hydraulic, electrical, pneumatic, mechanical, etc.) may be present if not isolated or released prior to working on the machine. Do not work on the machine without removing this stored energy (suspended loads, electrical power, air pressure, etc.). Risk of crushing, shock, or other physical injury exists if stored energy is not removed or isolated prior to working on the machine which could result in serious injury or death.

#### STRUCK-BY HAZARDS

- Struck-by hazards exist when around hydraulic fluid, air, fuel, or grease that is under pressure. Hoses under pressure can blow out or come loose from connections, causing a struck-by hazard with deadly force. DO NOT tighten or loosen hydraulic, air, fuel, or grease lines without first relieving the pressure. DO NOT make adjustments to any fluid pressures while the machine is running. Shut down the machine, make the adjustment, then restart the machine to check the adjustment. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly pressurized liquids or air. Failure to use proper PPE or to shut down the machine before making adjustments can cause a struck-by hazard resulting in serious injury or death.

#### BURN HAZARDS

- Burn hazards exist when around hot hydraulic fluid that is under pressure. Hoses under pressure can blow out or come loose from connections, causing a burn hazard from leaks or spraying. DO NOT tighten or loosen hydraulic fluid hoses without first relieving the pressure. DO NOT make adjustments to any fluid pressures or flow while the machine is running. Shut down the machine, make the adjustment, then restart the machine to check the adjustment. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly hot pressurized liquids. Failure to use proper PPE or to shut down the machine before making adjustments can cause a burn hazard resulting in serious injury or death.

**SKIN INJECTION HAZARD**

- Skin injection hazard exists when around diesel fuel, air, hydraulic fluid, or grease that is under pressure. Fluids under pressure can penetrate the skin and cause serious personal injury, blindness, or death. If any fluid is injected into the skin, it must be removed as soon as possible by a doctor familiar with treating this type of injury. Fluid or air leaks under pressure may not be visible. When searching for leaks, NEVER use your hand; use a piece of metal. Wear work gloves and keep your hand well away from the possible source of leakage. DO NOT tighten or loosen fuel, hydraulic, air, or grease lines without first relieving the pressure. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly pressurized liquids or air. Failure to use proper PPE can cause a skin injection hazard resulting in serious injury or death.

**CAUTION****CHEMICAL HAZARD**

- Chemical hazard and inhalation hazard exists if the appropriate Personal Protective Equipment (PPE) is not used when using solvents and compressed air. When working with chemicals, avoid contact with them and ensure proper ventilation is adequate. Ensure all required PPE is used. Follow all local rules and regulations when working with chemicals. Failure to use proper PPE and to avoid chemical contact could cause a chemical hazard and inhalation hazard resulting in serious injury.

This Page Intentionally Left Blank

# Theory of Operation

The hydraulic pumps are driven by a gearbox assembly that is mechanically powered by the generator via a driveshaft. The gearbox provides areas for mounting a variety of pumps. It attaches to the generator by means of a driveshaft. Internally, the gearbox has sets of gears that drive the externally mounted pumps.

## Fluid Specifications

Model	Component	Capacity		Lubrication
L1350/L1850/L2350	Hydraulic Pump Drive Gearbox <sup>2</sup>	7 gallons	27 liters	SAE 75W-140W synthetic gear oil or SAE 80W-90W gear oil.
1 ARCTIC CONDITIONS represent a specialized field where extensive use is made of heating equipment before starting.				
2 Refer to Section 3 of this manual. The hydraulic pump drive gearbox is factory equipped with synthetic oil.				

**Table 1. HPD gearbox fluid specifications**

This Page Intentionally Left Blank

# Component Description

## Machines without Remote Fluid Drain and Fill Components

#	Component	Use / Description	Specification	Location
1.	HPD Gearbox Lubricant Pump	Vane Hydraulic Pump Pump Gearbox Lube	12 gpm (45 lpm) 0 to 200 psi	Mounted on non-drive side of HPD gearbox.
2.	Oil Cooler	Cool gearbox lubricating oil.	N/A	Mounted by radiator
3.	Sequence Valve	Pressure limiting check valve - regulates pressure flow into control valve.	200 psi (13.7 bar)	Oil Cooler Control Valve - bottom of HPD gearbox
	Check Valve	Pressure Limiting Check Valve - regulates pressure flow into oil cooler.	100 psi (6.9 bar)	Oil Cooler Control Valve - bottom of HPD gearbox
	Temperature Sending Unit	Monitors oil temperature for visual and audible alarm.	Variable	Oil Cooler Control Valve - bottom of gearbox
<b>Not Shown</b>	Pressure Transducer	Monitors oil pressure for visual and audible alarm.	Variable	PSI Transducer manifold. Connects to sequence valve.
4.	Oil Filter	Filter lubricating oil	Canister filter	Beside HPD
5.	Separator/Diffuser	Separates the oil from the air that comes up the breather hose when the gearbox is cold. (Air goes out the breather and oil drains back to the gearbox).	Same as planetary drive filtration separator. (different plumbing)	Mounted between gearbox and breather filter.
6.	Air Breather Filter	Air filter ventilation	Canister-type filter	Mounted behind cab on hood structure.
7.	Fluid Level Sight Glass	To visually determine HPD fluid level	Two	On the non-driven side, lower corners

A Looking down on top of radiator (radiator not to scale)

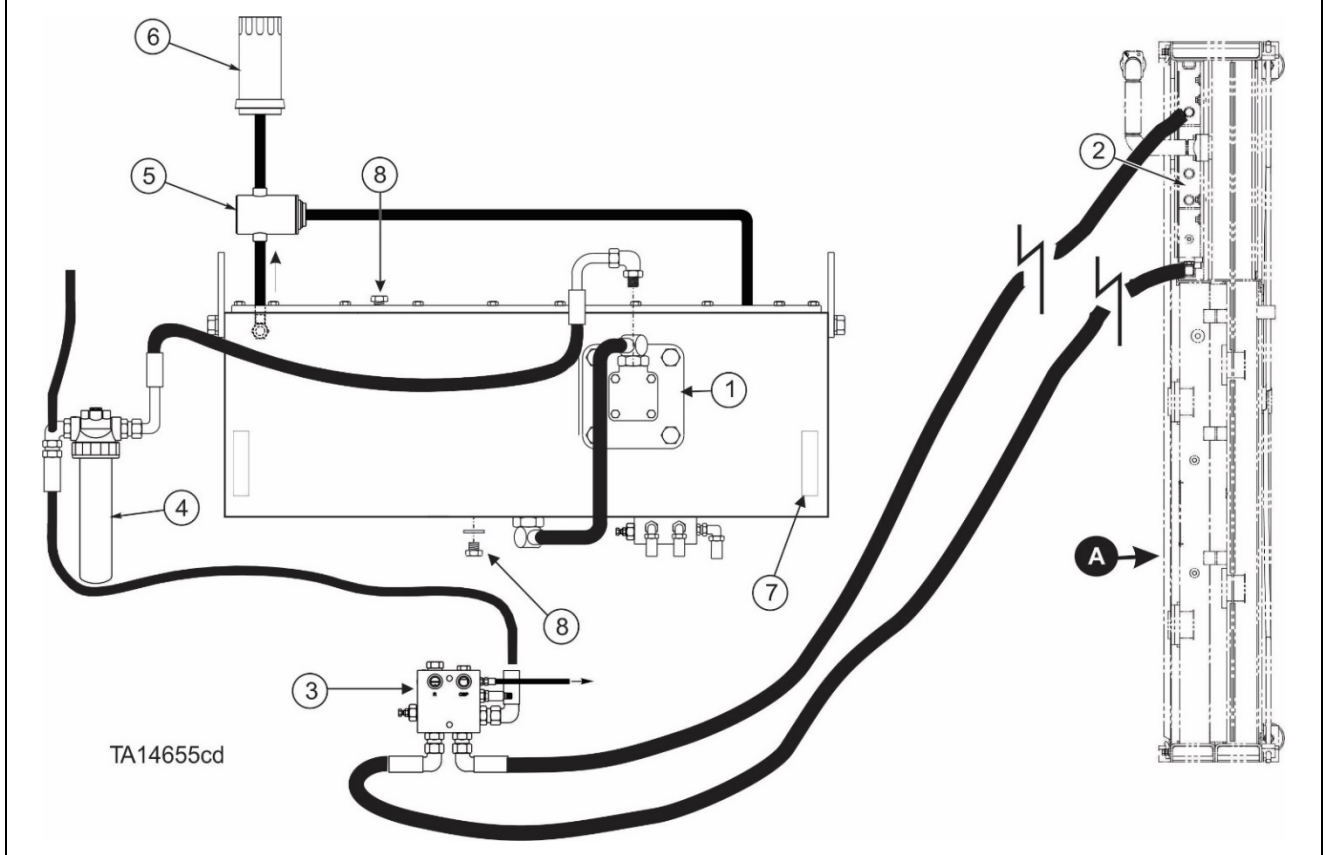
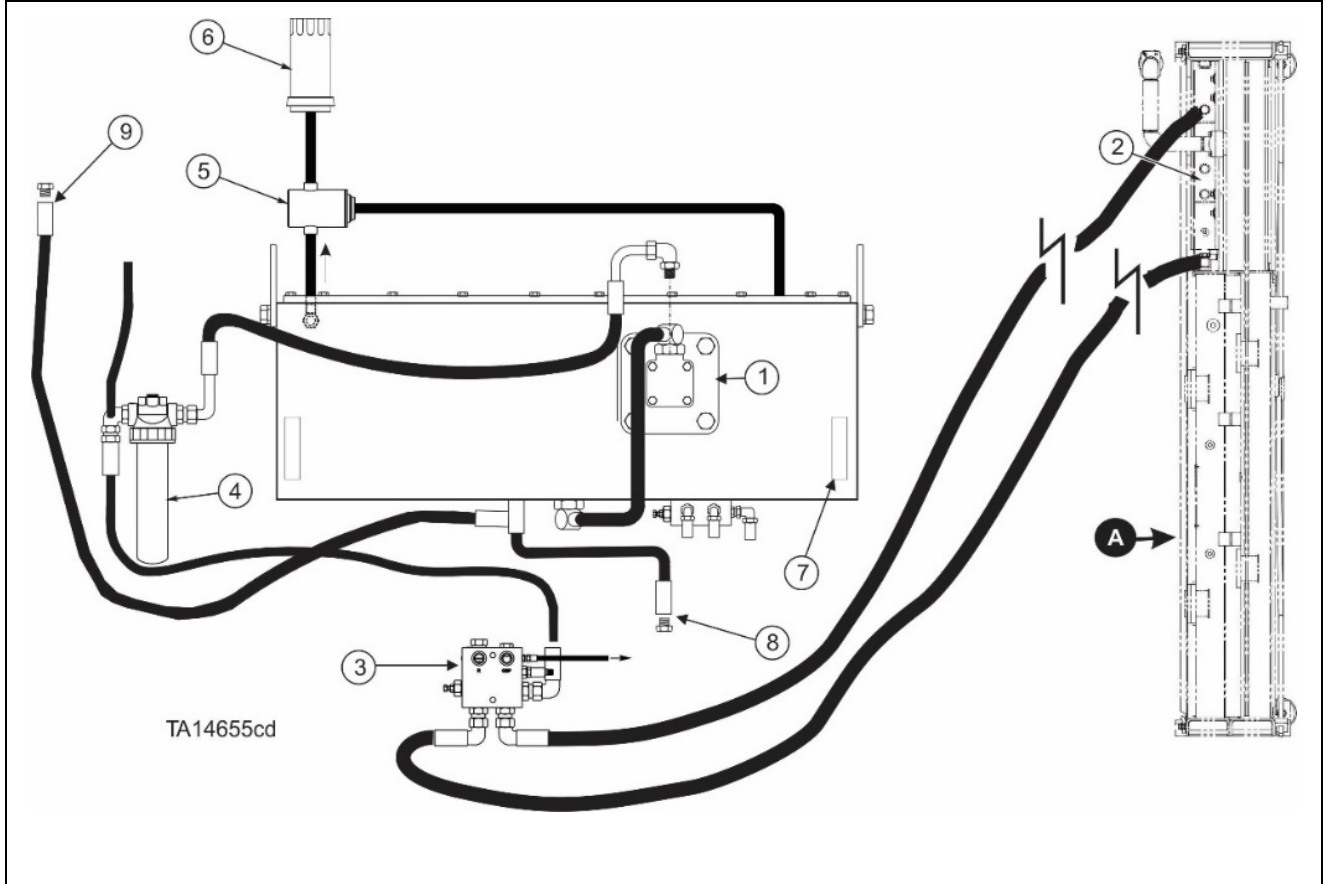


Table 2. HPD gearbox components (typical)

# Machines with Remote Fluid Drain and Fill Components

#	Component	Use / Description	Specification	Location
1.	HPD Gearbox Lubricant Pump	Vane Hydraulic Pump Pump Gearbox Lube	12 gpm (45 lpm) 0 to 200 psi	Mounted on non-drive side of HPD gearbox.
2.	Oil Cooler	Cool gearbox lubricating oil.	N/A	Mounted by radiator
3.	Sequence Valve	Pressure limiting check valve - regulates pressure flow into control valve.	200 psi (13.7 bar)	Oil Cooler Control Valve - bottom of HPD gearbox
	Check Valve	Pressure Limiting Check Valve - regulates pressure flow into oil cooler.	100 psi (6.9 bar)	Oil Cooler Control Valve - bottom of HPD gearbox
	Temperature Sending Unit	Monitors oil temperature for visual and audible alarm.	Variable	Oil Cooler Control Valve - bottom of gearbox
<b>Not Shown</b>	Pressure Transducer	Monitors oil pressure for visual and audible alarm.	Variable	PSI Transducer manifold. Connects to sequence valve.
4.	Oil Filter	Filter lubricating oil	Canister filter	Beside HPD
5.	Separator/Diffuser	Separates the oil from the air that comes up the breather hose when the gearbox is cold. (Air goes out the breather and oil drains back to the gearbox).	Same as planetary drive filtration separator. (different plumbing)	Mounted between gearbox and breather filter.
6.	Air Breather Filter	Air filter ventilation	Canister-type filter	Mounted behind cab on hood structure.
7.	Fluid Level Sight Glass	To visually determine HPD fluid level	Two	On the non-driven side, lower corners
8.	Fluid Drain	To drain the fluid from the HPD gearbox	Some models have a remote hose with plug.	In upper and lower articulation area, inside rear frame.
9.	Fluid Fill	To fill the HPD gearbox with fluid.	Some models have a remote hose with plug.	In upper and lower articulation area, inside rear frame.
<b>A</b>	Looking down on top of radiator (radiator not to scale)			



**Table 3. HPD gearbox components with remote fluid drain and fill fittings (typical)**

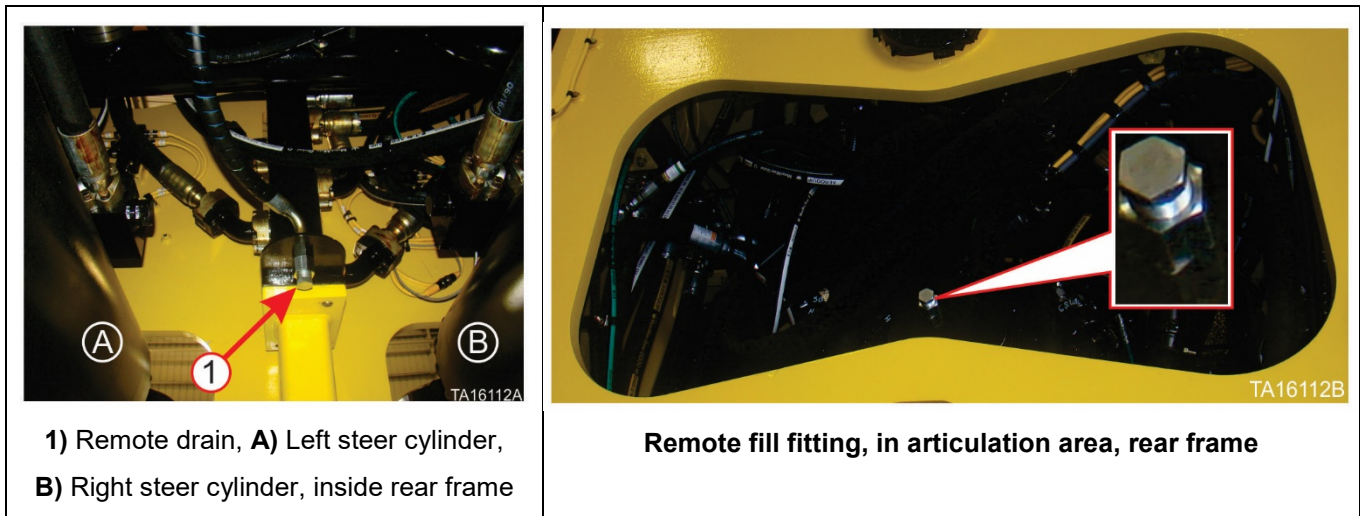


Figure 1. Remote Drain and Fill locations on HPD (optional)

### Sight Glasses

Mechanical sight glasses used to determine the oil level inside the gearbox are mounted on each side, on the non-drive end of the gearbox.

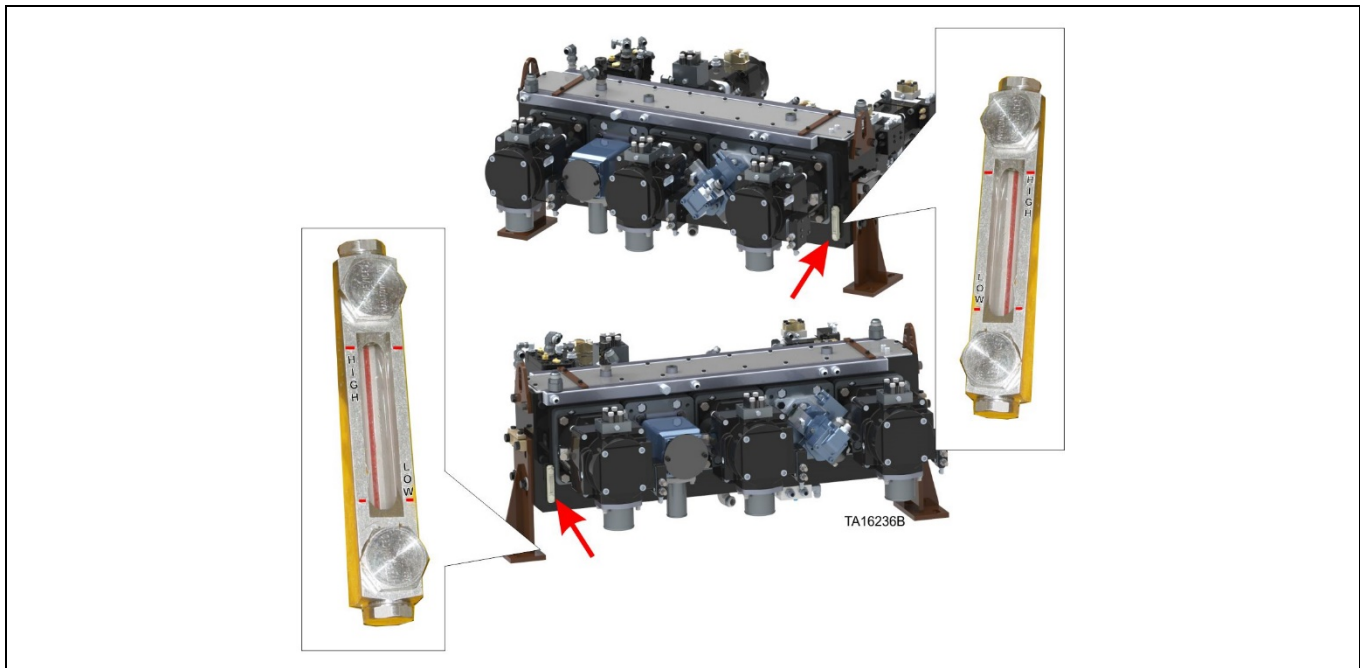


Figure 2. Sight glass with “high” (full) and “low” level indicator marks (glass shown empty).

## NOTICE

**Do NOT overfill the gearbox. Heat buildup can occur which could damage bearings and gears.**

The “full” level is the “high” mark at the upper end of the sight glasses. Maintain the level at that mark. DO NOT overfill beyond that level. The lubricant level should be checked while close to normal operating

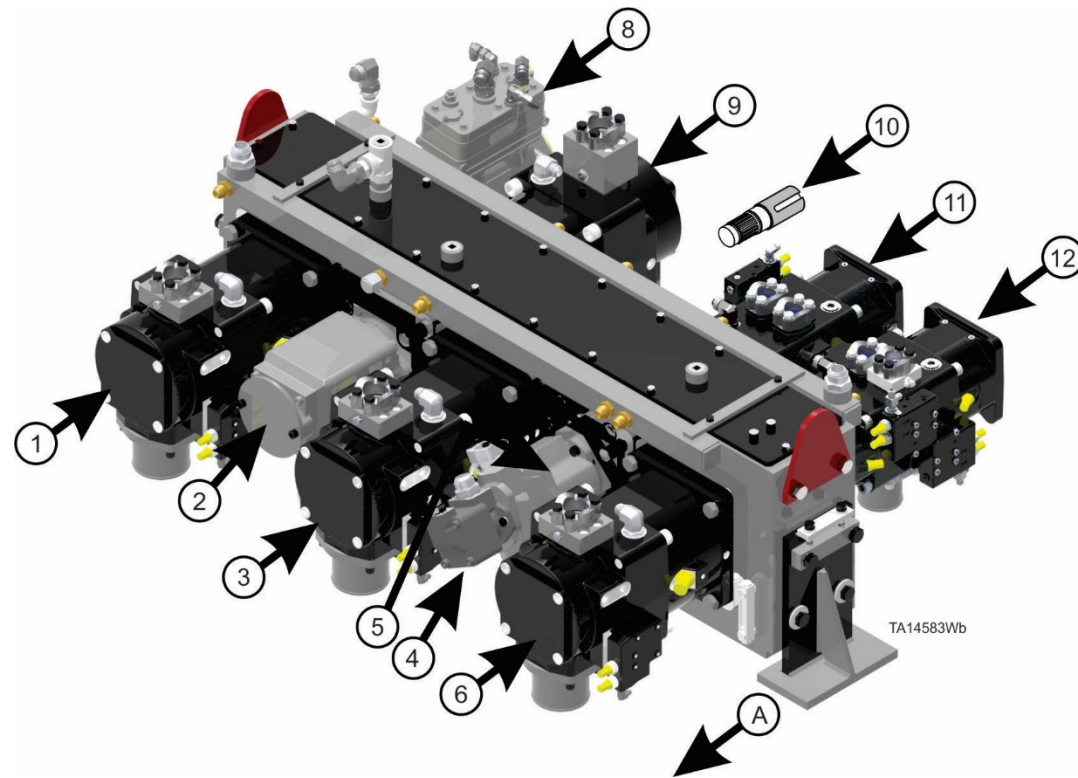
temperature. Wait 10 minutes after stopping the engine before checking the level. This allows any residue (due to possible foaming) to drip back into the gearbox from the breather hose and strainer.

## NOTICE

**Overfilling the gearbox can cause fluid to be expelled from the breather causing an environmental impact.**

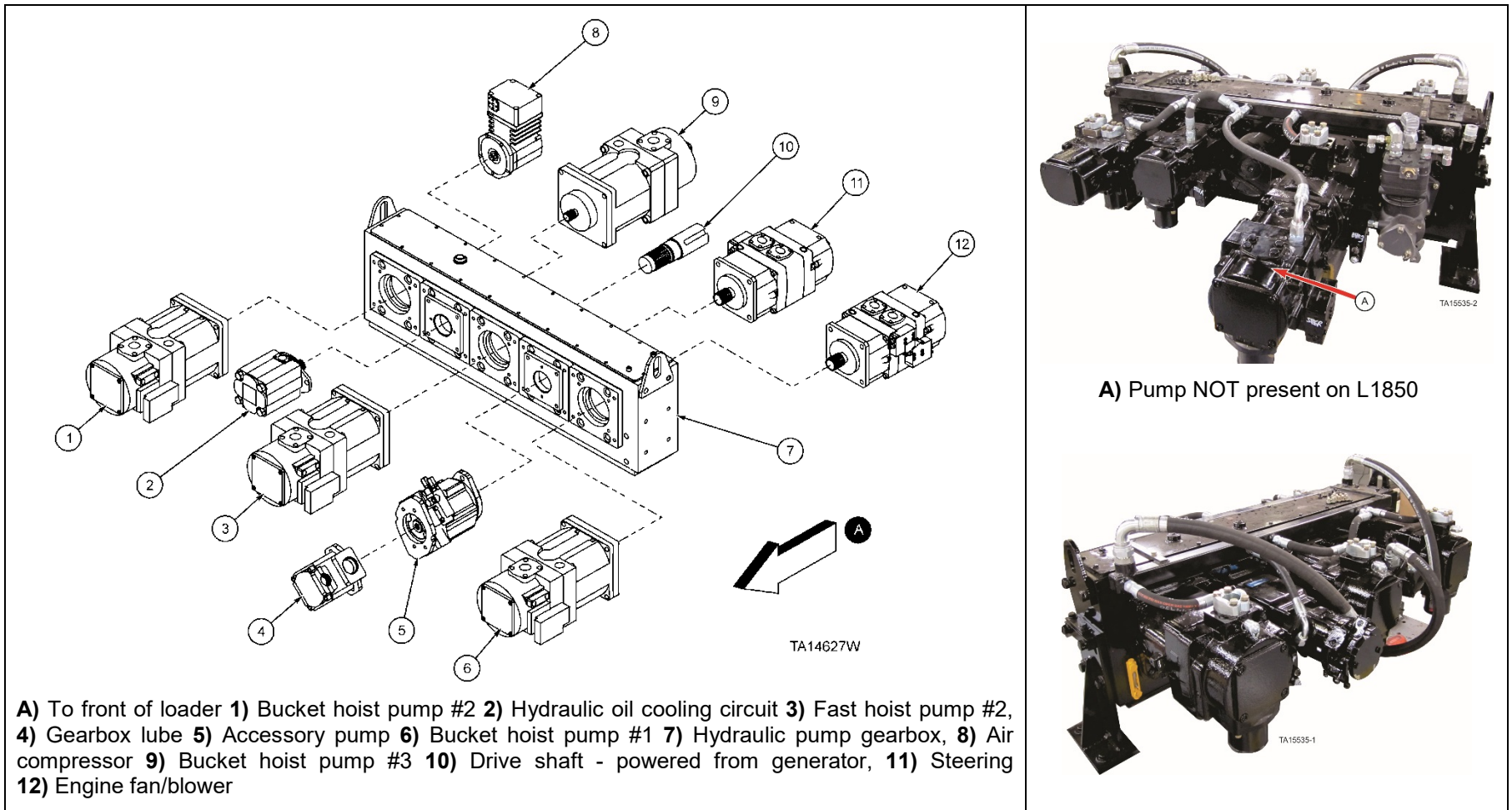
## NOTICE

**There are two sight glasses on the HPD: One on either end. The machine should be stopped (and shut down) on as level ground as possible (especially side-to-side) before reading the lubricant level in the sight glasses.**



A) to front of loader, 1) Main pump #3, 2) Hydraulic oil cooling circuit 3) Main pump #2, 4) Gearbox lube, 5) Accessory pump, 6) Main pump #1, 7) Hydraulic pump gearbox, 8) Air compressor, 9) Cover plate, 10) Driveshaft - powered from generator, 11) Steering, 12) Engine fan/blower

**Figure 3. L-1350 hydraulic pump arrangement (typical pump types are illustrated)**



**Figure 4. L-1850 hydraulic pump arrangement (typical pump types are illustrated)**

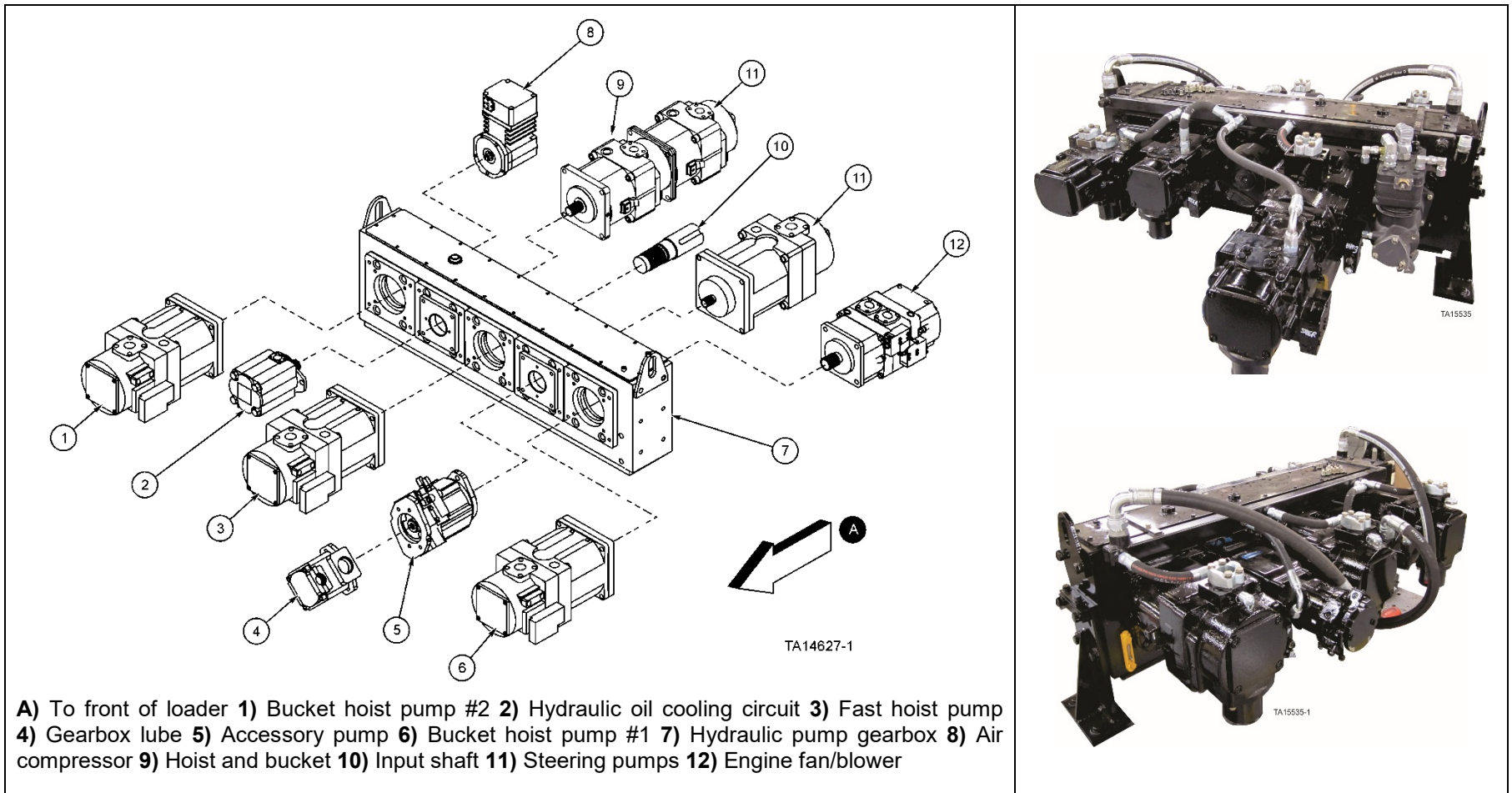


Figure 5. L-2350 hydraulic pump arrangement (typical pump types are illustrated)

This Page Intentionally Left Blank

# Circuit Description for HPD Gearbox Oil

## Components used in the Gearbox Oil Circulation Pump circuit:

- HPD Gearbox Oil Cooler Circulation Vane Pump (approximately 18 gpm (68 lpm))
- HPD Gearbox Oil Control Valve
- Check Valve 100 psi (6.9 bar)
- Sequence Valve (pressure reducing)
- Oil Cooler (located at the radiator)
- Pressure Transducer

For description of the Gearbox Oil Circulation Pump function, the following assumptions are made:

Engine is running at high throttle (~1800 rpm), Hydraulic oil level in the hydraulic reservoir is correct, Gearbox and Control valve operation is correct.

## Overview of the Gearbox Oil Circulation Pump function:

The gearbox oil circulation pump provides gearbox bearing lubrication oil and oil flow through an oil cooler. An internally mounted manifold distributes lubricating oil to the internal gearbox gears. As the gears inside the gearbox turn, part of the pressurized oil is delivered to the tapered roller bearings. The remaining oil is directed to an oil cooler that is located inside the engine radiator shroud. The pressure and temperature of the gearbox oil is monitored by LINCS with warnings and alarms generated for out of limit conditions. Mechanical sight glasses used to determine the oil level inside the gearbox are mounted on each side, on the front of the gearbox.

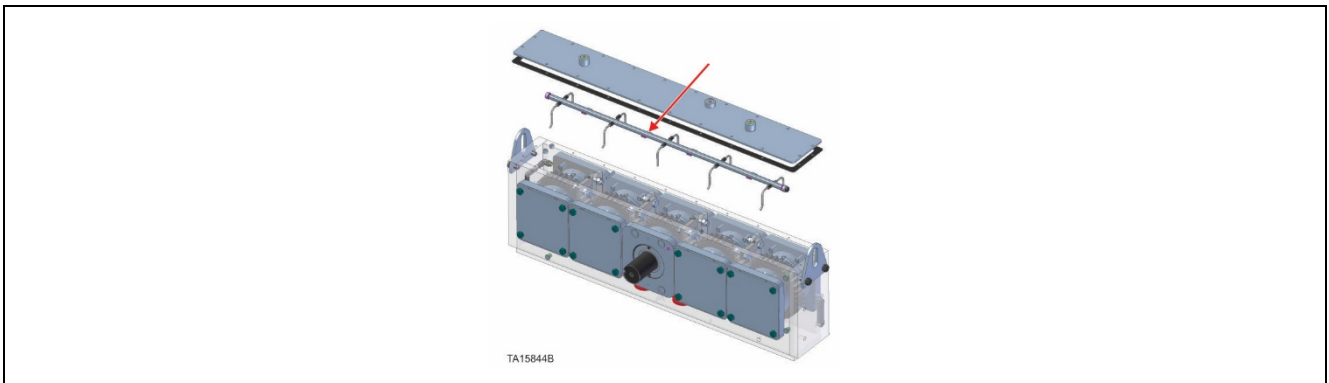
## Detailed description of the Gearbox Oil Circulation Pump circuit:

The gearbox oil is monitored for pressure and temperature. The electrical components used are a pressure transducer (4-20ma sensor) and a temperature probe (4-20ma sensor). The pressure and temperature transducers and cables are monitored by the LINCS II control system for a high or low failure. If the oil pressure goes below 10 psi (0.069 bar) for more than 5 seconds, a red alarm is generated on the operator's screen and an engine shutdown sequence begins. If the gearbox oil temperature goes above 205° F (96° C) for 0.5 seconds, a yellow warning is displayed on the operator's screen.

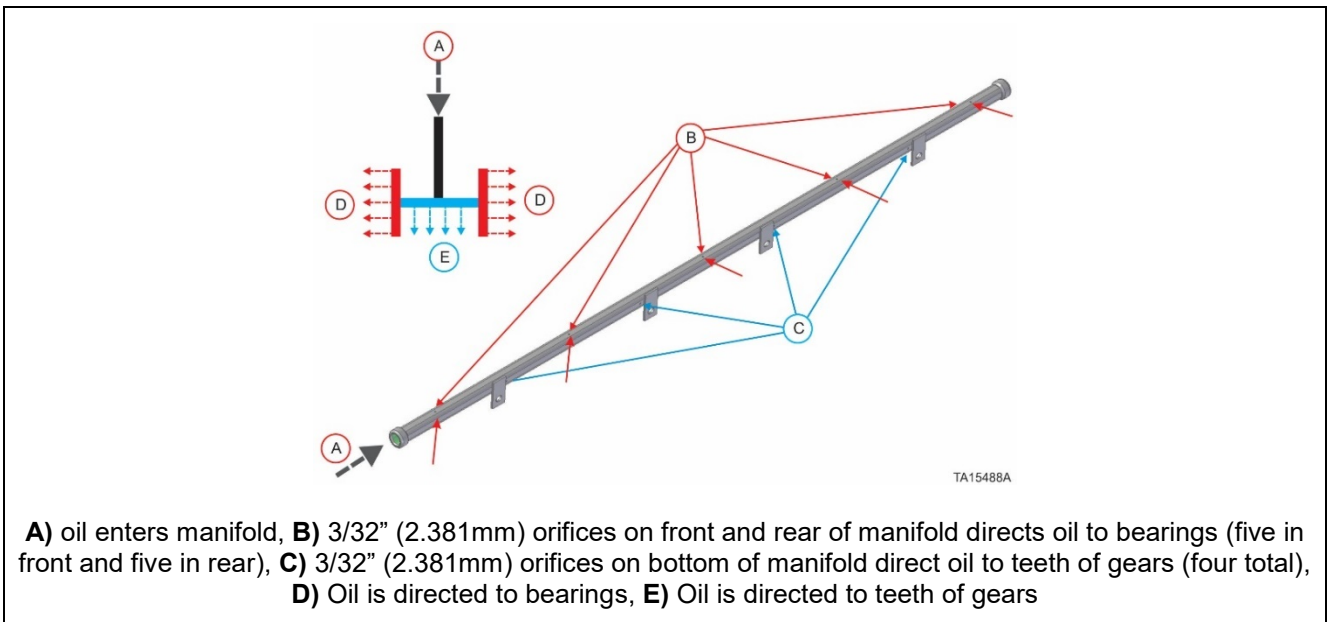
## Detailed fluid flow description of the Gearbox Oil Circulation Pump:

The gearbox oil circulation pump circulates the oil in the gearbox housing. The oil is drawn from the bottom of the gearbox. The circulation pump is a constant displacement vane pump. As the oil flows out of the pump, it is directed to a pressure filter. From the pressure filter, the oil flows to the gearbox oil control valve. The gearbox oil control valve consists of a 100 psi (6.9 bar) check valve, a sequence valve (pressure control), temperature probe, and pressure transducer. As the oil enters into the control valve it is directed to the oil cooler and the sequence valve. The oil cooler has a set amount of oil flow restriction causing the pressure from the pump to increase. The sequence valve senses this pressure and relieves excessive pressure to a return galley in the control valve. The sequence valve is set at 200 psi (13.7 bar). The return galley in the control valve has a 100 psi (6.9 bar) check valve that restricts the oil returning to the gearbox. This 100 psi (6.9 bar) back pressure oil is then directed to the pressure transducer, temperature probe, and to an oil manifold with oil tubes.

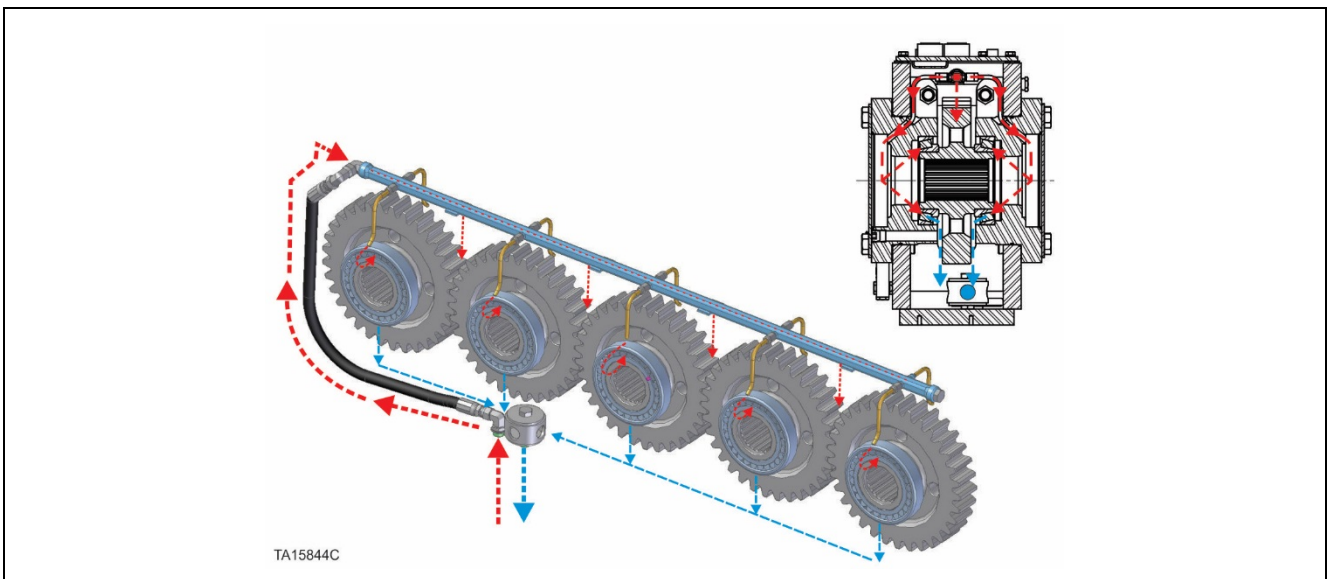
The oil manifold is located internally across the top of the gearbox.



**Figure 6. Hydraulic pump drive (HPD) oil manifold (typical) location**



**Figure 7. Hydraulic pump drive (HPD) oil manifold orifices**



**Figure 8. Hydraulic pump drive (HPD) internal oil circulation**

There are five orifices in the front, five in the rear, and four in the bottom of the manifold. The orifices are 3/32" (2.38 mm) and must not be modified. The size of the orifices is calculated to allow a set amount of oil to pass through each orifice. Tubes are connected over the orifices that direct oil to an oil galley located above each bearing in the gearbox. This oil lubricates and cools the bearings during operation. There are four orifices on the bottom of the manifold that spray oil into the teeth of each gear, for lubrication. After the oil has flowed through the bearings, or over the gear teeth, it flows back into the sump of the gearbox.

Oil that flowed through the oil cooler is cooled by the engine fan air flow. The cooled oil is then directed back to the gearbox housing where the cooled oil is combined with the rest of the gearbox oil.

## CAUTION

**If removing and replacing the gearbox lube pump, create a record of the seal orientation. The seal is reversed to prevent cross-contamination of gearbox lubricant and hydraulic oil.**

## NOTICE

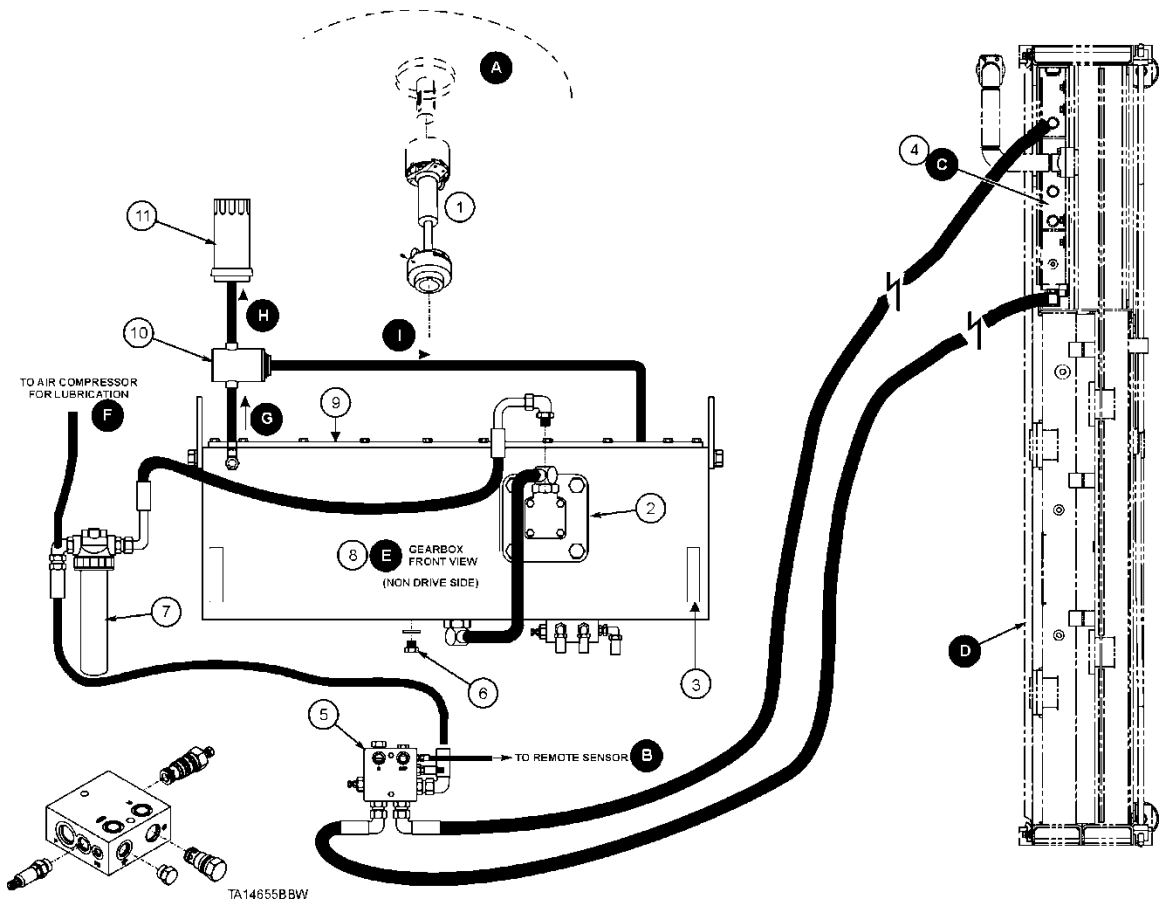
**Some of the oil exits the gearbox filter fitting which is used to lubricate the HPD gearbox mounted air compressor.**

## NOTICE

**Remove all paint, rust and debris from mating surfaces of all bolts 3/4" or larger and torque per specifications listed on the "Capscrew and Bolt-Nut Torque Specifications".**

- 1. Drive shaft
- 2. Lube pump
- 3. Fluid level sight glass
- 4. Oil cooler (typical)
- 5. Control valve
- 6. Drain plug (Some models have a remote drain).

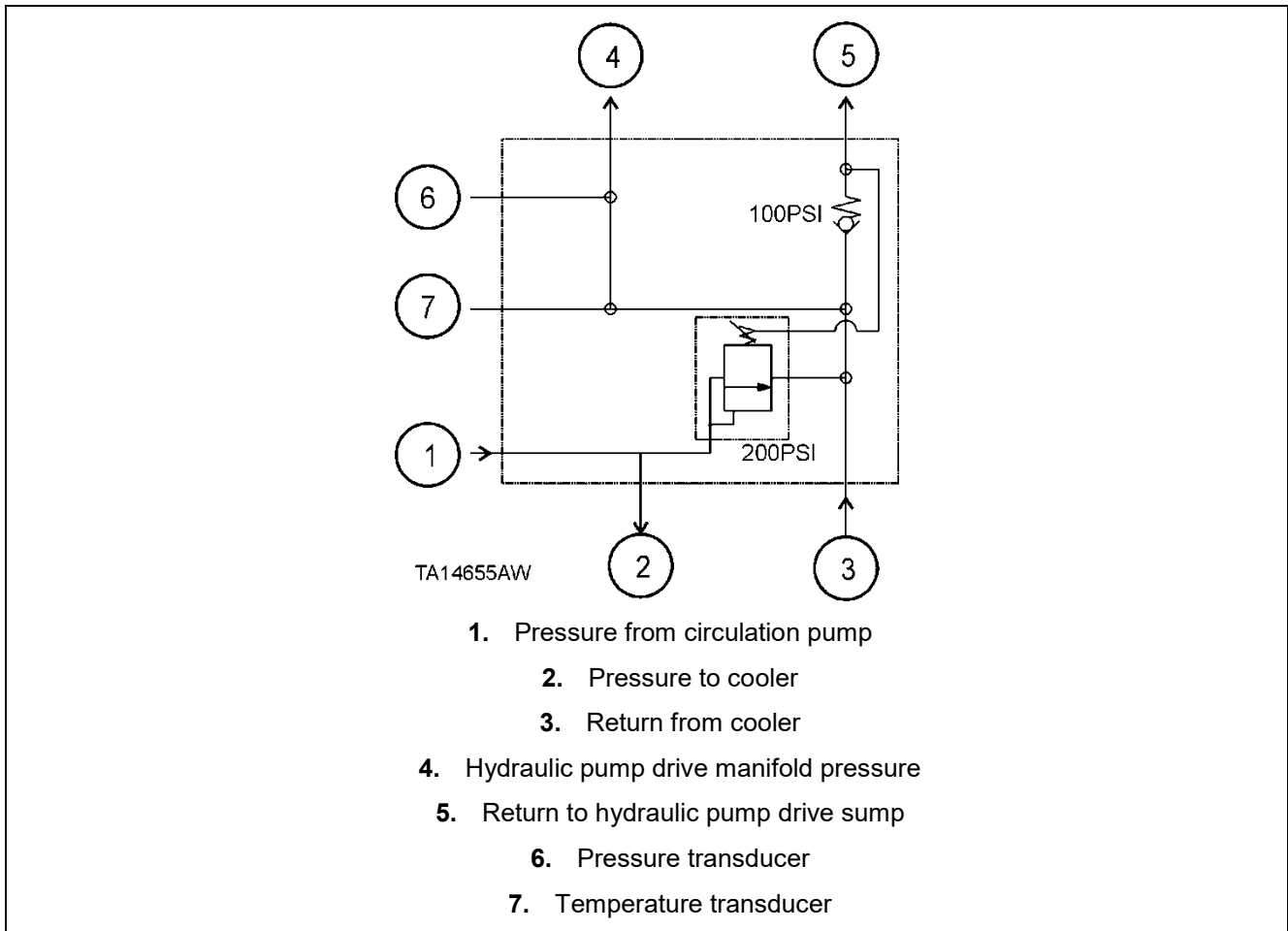
- 7. Oil filter
- 8. HPD gearbox (typical)
- 9. Fill plug
- 10. Separator
- 11. Air breather filter



- A. Generator
- B. To remote sensor
- C. Oil cooler
- D. Looking at top of radiator (not to scale)
- E. Gearbox front view (non drive side)

- F. To air compressor for lubrication (gearbox mounted air compressors only).
- G. Oil and air
- H. Air
- I. Oil back to gearbox

Figure 9. HPD gearbox oil cooler circuit components (typical)



**Figure 10. Hydraulic pump drive (HPD) oil cooler circuit (typical)**

This Page Intentionally Left Blank

# Removal/Installation Procedures

## HPD Gearbox Removal, Disassembly, and Assembly

### Safety Preparations

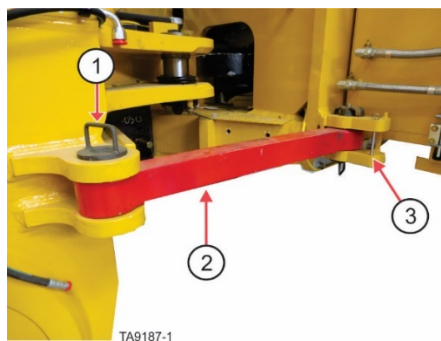
 **WARNING**

Crush hazards exist if the machine is started or moved while work processes are being performed on the machine. Place bucket flat and level on the ground. Place frame lock in the locked position and lock out the machine’s starting capability before performing any work process. Follow all applicable lockout procedures and local rules and regulations for performing work processes. ANYONE performing inspections or service procedures to the machine should be familiar with ALL instructions and procedures contained in the machine’s SERVICE MANUAL. Crush hazard could occur if the machine is started or moves while any type of work process is being conducted on the machine, resulting in serious injury or death.

- a. Ensure the bucket is empty and clear of debris.
- b. Park the machine in the wash bay with the bucket flat on the ground.
- c. Move the frame lock to the locked position so that the frame cannot be steered.
- d. Place wheel chocks in front and behind each wheel.

 **WARNING**

Crush hazards exist if the frame lock is not locked to prevent machine articulation while personnel are in the machine articulation area. Do not enter this area unless you have verified that the operator has control over the steering and that you have good communication with the operator. Crush hazard is possible if personnel are in this area while the machine is articulated, which could result in serious injury or death.



**Frame lock in locked position**

- 1) Retaining pin for locked position, 2) Frame lock - shown in locked position,
- 3) Retaining pin bracket for un-locked position

**Figure 11 Frame Lock**

- e. Set bucket flat and level on the ground.
- f. Set the parking brakes.

- g. Shut off the engine.

## **WARNING**

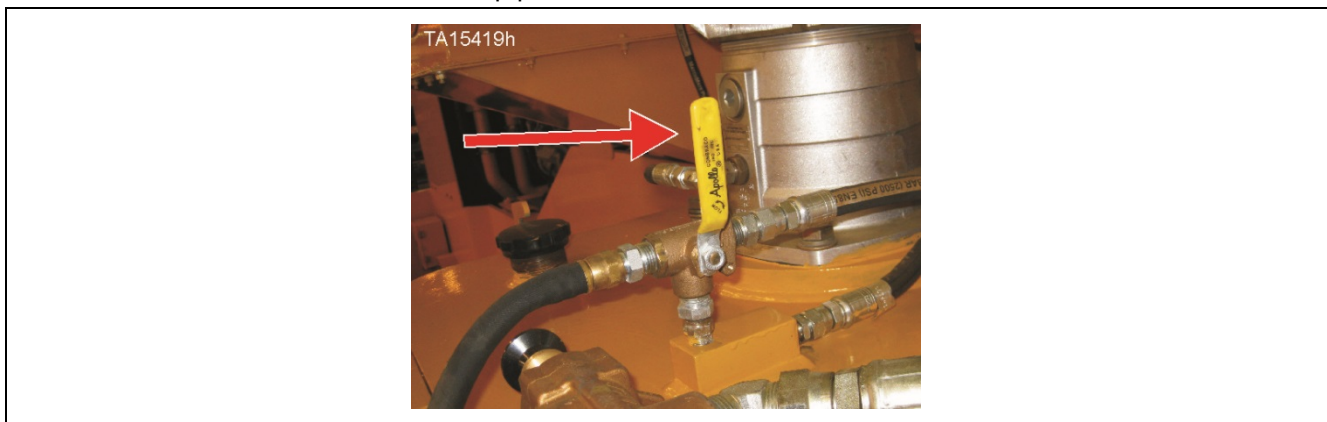
Crush, shock, or other hazards exist if stored energy is not removed or isolated prior to working on the machine. Stored energy (hydraulic, electrical, pneumatic, mechanical, etc.) may be present if not isolated or released prior to working on the machine. Do not work on the machine without removing this stored energy (suspended loads, electrical power, air pressure, etc.). Risk of crushing, shock, or other physical injury exists if stored energy is not removed or isolated prior to working on the machine which could result in serious injury or death.

- h. Turn the battery and engine isolation switches to the off position and install locks on the battery isolation switch.



**Figure 12. Battery Isolation Box – Battery isolation switch in OFF position with locks in place**

- i. Release the air from the hydraulic reservoir by using the hydraulic reservoir air valve (ball valve) on top of the reservoir. The supply line from main air system will be blocked and reservoir air will vent out the hose that runs down the outside of the hydraulic reservoir.
- Turn the handle to the up position as shown



**Figure 13. Hydraulic reservoir air valve handle UP**

- j. Release the air from the various air storage reservoirs by opening all of the air bleed valves.

Three valves on right side of rear frame under hydraulic reservoir
One valve on right side of front frame near hoist cylinder ball cap

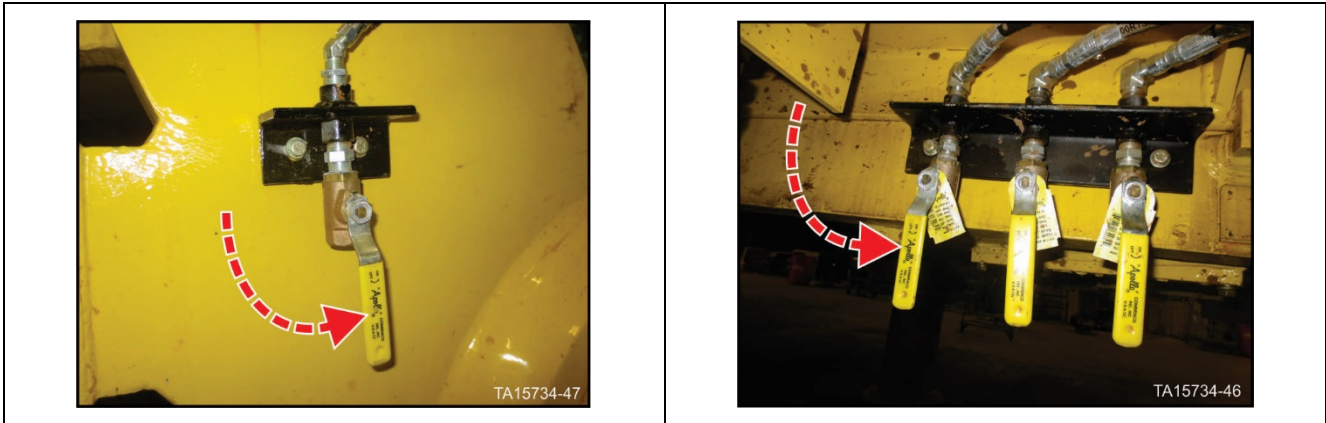


Figure 14. Open air reservoir bleed valves

**⚠ WARNING**

Crush hazards exist if all personnel are not cleared from the bucket and lift arm area before using the hydraulic hoist and bucket hydraulic pressure bleed down valves to relieve pressure from the hoist and bucket circuit. Clear all personnel from the area around the bucket and lift arms before operating hydraulic hoist and bucket hydraulic pressure bleed down valves. Using the hydraulic bleed down valves could result in some movement of the lift arms and bucket which could cause a crush hazard resulting serious injury or death.

- k. Use the hydraulic pressure bleed down valves located in the front frame underneath the Husco valves to bleed any stored pressure in the hoist and bucket cylinders.
- l. Turn each valve slowly counterclockwise as shown below and allow the pressure to bleed down.
- m. Open the valve completely and leave it open during the repair of the manifold.

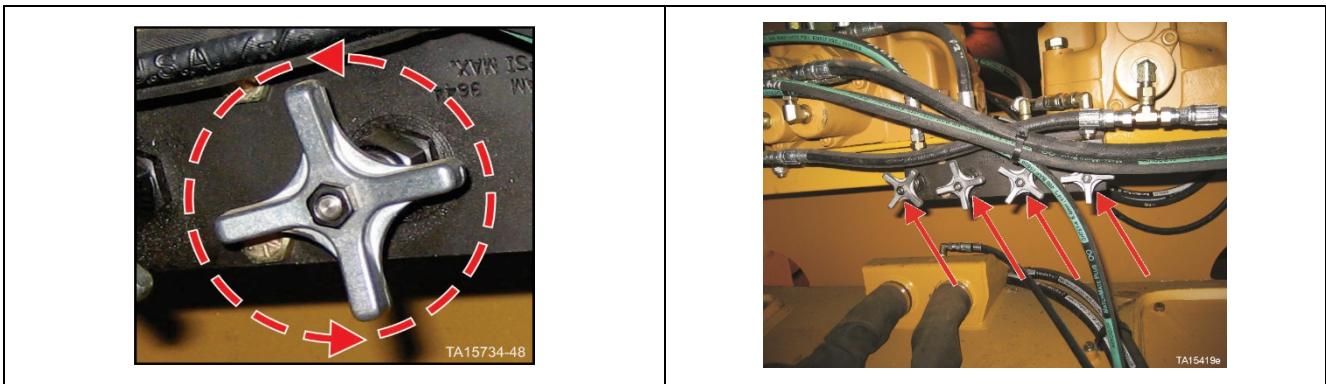


Figure 15. Pressure bleed down valves

## Removal

The illustrations in this section show a TYPICAL gearbox being removed/installed. Some models have fewer pumps than what is shown. The following instructions are similar for all models.

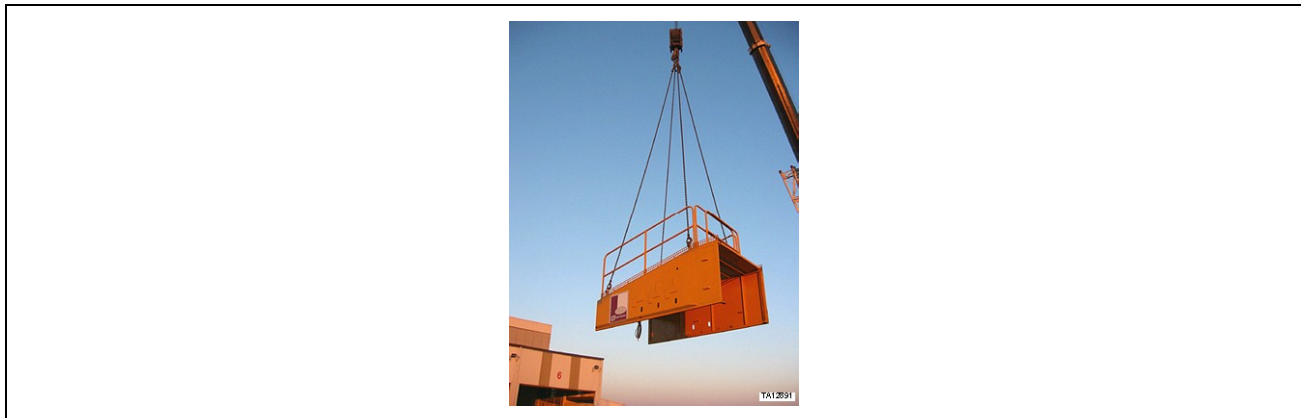
# NOTICE

**Removal and installation of the HPD gearbox requires either a truck-mounted crane or overhead crane of sufficient height and capacity to lift the hood assembly, the combined (cooling air system, air filtration unit, and blower assembly,) and the gearbox with pumps attached.**

Item/Equipment	LBS.	KGS.
Hood Structure (Without Attachments such as Fire System, etc)	2,000	908
Cooling Air System/Air Filtration Unit/Blower	4,000	1,815
Hydraulic Pump Gearbox (L1350) (without pumps)	2,300	1,044
Hydraulic Pump Gearbox (L1350) (with pumps)	4,500	2,042
Hydraulic Pump Gearbox (L1850) (without pumps)	2,300	1,044
Hydraulic Pump Gearbox (L1850) (with pumps)	4,500	2,042
Hydraulic Pump Gearbox (L2350) (without pumps)	2,300	1,044
Hydraulic Pump Gearbox (L2350) (with pumps)	5,000	2,268

**Table 4. Typical weights for components**

- a. Release hydraulic reservoir air pressure with the manual air release valve located on top of the hydraulic reservoir.
- b. Remove the catwalk grating and cross-member anchoring grating behind the operator’s cab.
- c. Remove the front hood structure.

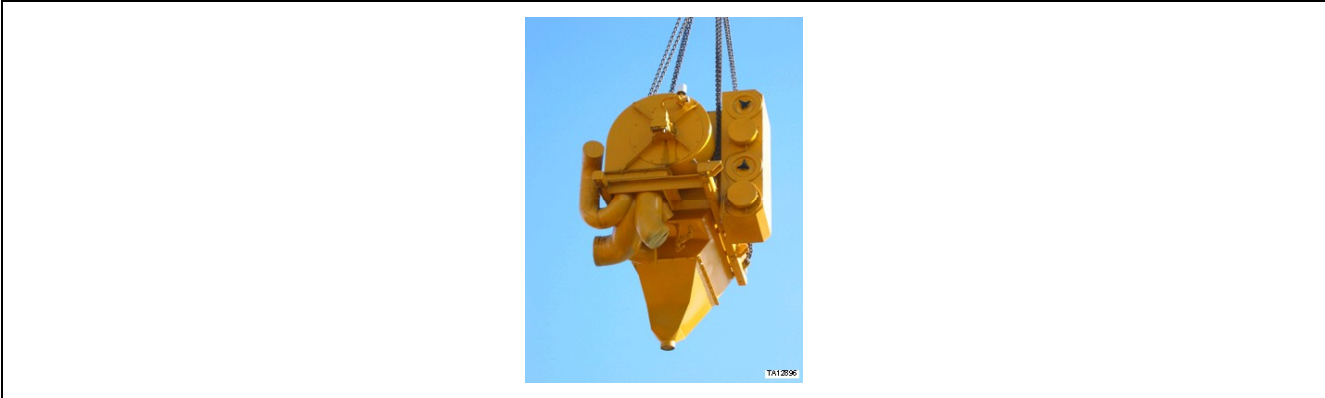


**Figure 16. Hoisting of hood assembly**

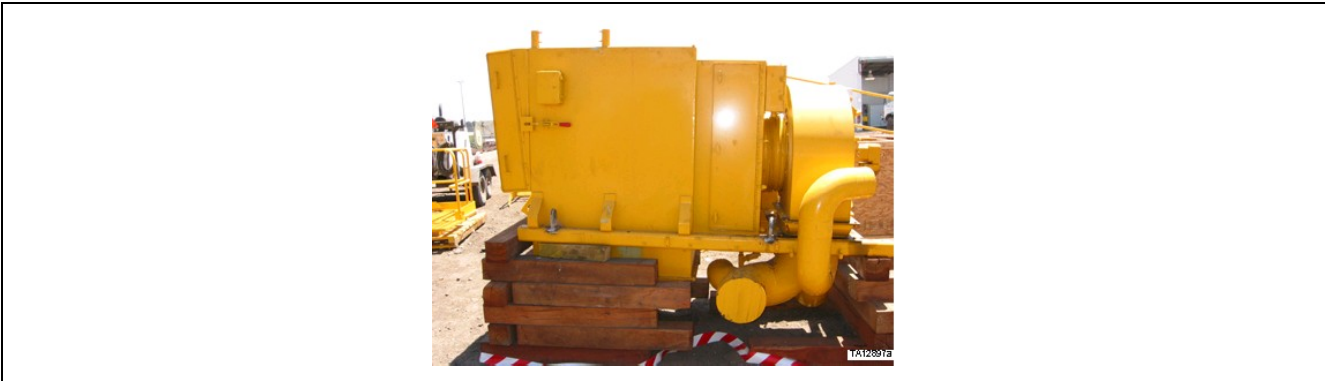
- d. Remove central air blower assembly and KLENZ™ air filtration unit.

# CAUTION

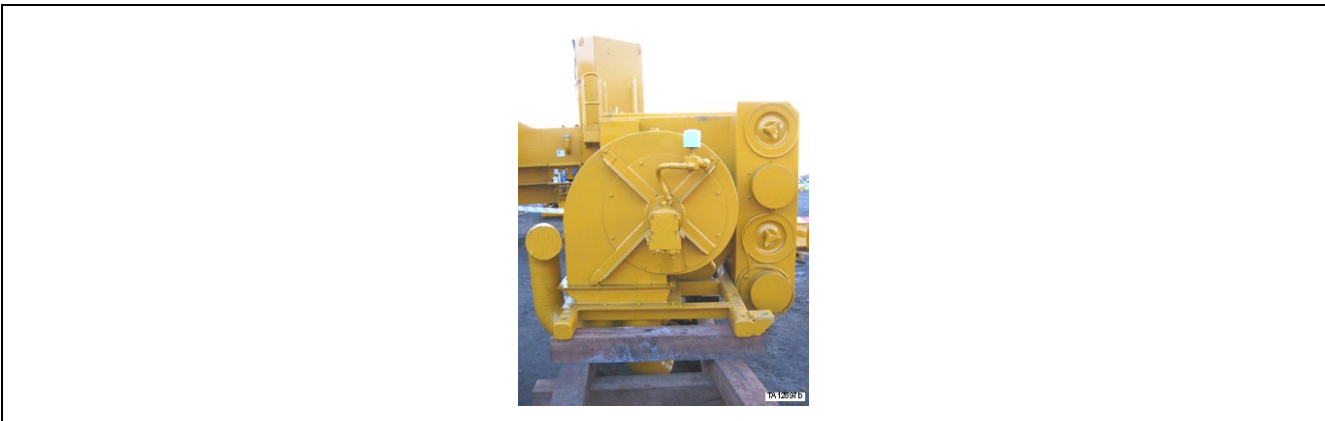
Wooden cribbing is required to support the KLENZ™ air filtration unit and blower to ensure no damage is done to housings or tubing when the units are removed from the machine. Remove the KLENZ™ air filtration and blower assembly as a unit. Position the assembly on wooden cribbing to ensure no damage occurs to tubing or housings. Securely cover all openings to prevent ingress of dirt or debris.



**Figure 17. Hoisting of KLENZ™ and blower assembly**



**Figure 18. KLENZ™ and blower assembly supported by cribbing - 1 of 3**



**Figure 19. KLENZ™ and blower assembly supported by cribbing - 2 of 3**



**Figure 20. KLENZ™ and blower assembly supported by cribbing - 3 of 3**

- e. Disconnect drive shaft U-joint from hydraulic pump drive.
- f. Tag and disconnect the hoses from the hydraulic pumps. Then cap the openings to prevent foreign material from entering.
- g. Remove the bolts, flatwashers, and lockwashers securing the mounting structures to the frame of the loader.
- h. Attach a suitable hoist to the eye brackets and lift the gearbox clear of the loader and into a prepared area.

## HPD Gearbox Disassembly

Refer to illustration (select appropriate model) "HPD gearbox assembly" at the end of this document unless otherwise noted.

- a. Remove the bolts, nuts, and lockwashers to allow the hydraulic pumps to be removed along with the associated O-rings and adapter sleeves.

## NOTICE

**Do not disassemble retainer, bearing and input shaft unless inspection reveals excessive wear.**

- b. Remove hose connections to disconnect the HPD air filter.
- c. Provide a suitable container, then remove the plug and drain the gearbox oil. The hydraulic pump drive oil capacity is:
  - L1350/L1850/L2350: 7 gallons (26.5 liters).
- d. Remove bolts and lockwashers securing cover plate structure. Remove cover plate and gasket.
- e. Disconnect tube assembly from tube manifold structure.
- f. Disconnect and remove the tube manifold structure by removing bolts and lockwashers.

## NOTICE

**Do not disassemble the tube manifold structure unless inspection reveals damage.**

- g. Remove hose assemblies to disconnect the oil filter assembly.

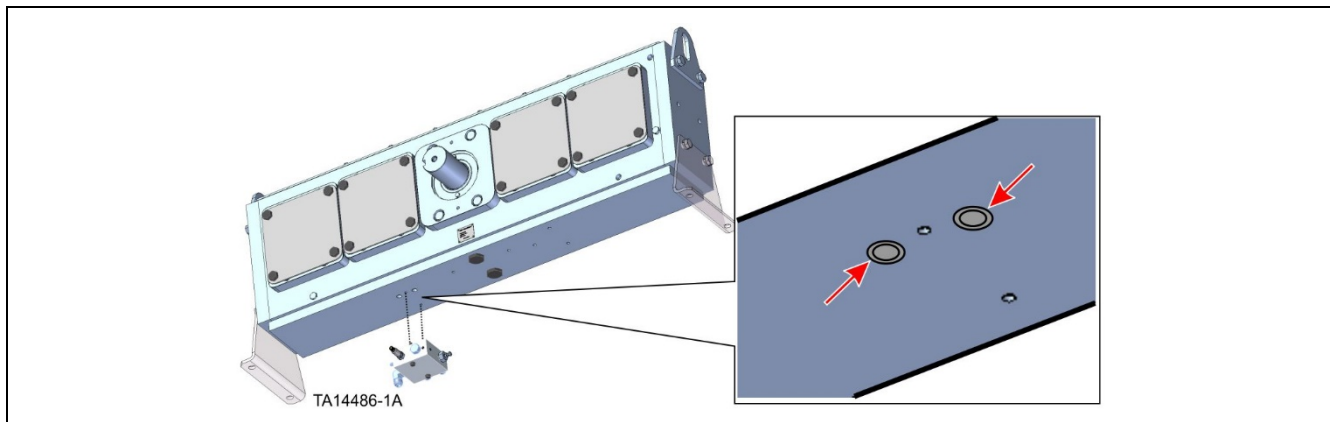
## NOTICE

**Make record of or mark each bearing housing as to its location so as not to confuse the positioning during disassembly.**

- h. Remove the bolts and lock washers to allow removal of the output bearing housings with O-rings.
- i. The bearing races must be pressed from the housings.
- j. Remove the drive gears.

### Inspection

- a. Check all the bearings for excessive play, pitting or discoloration. Replace any found defective.
- b. Inspect the gears for broken or worn teeth, pitting, discoloration, or damaged splines. Replace any found defective.
- c. Inspect all splined components for wear or damage. Replace any found worn beyond serviceability.
- d. If gear failure has occurred, check the housings for cracks.
- e. Inspect the two holes under the gearbox oil cooler control valve attached to the bottom of the gearbox.
  - If the holes have grooves cut into the box, weld up the O-ring grooves surrounding the holes and machine flat.
  - If a spacer plate exists between the control valve and the gearbox, discard the plate, weld up the O-ring grooves around the holes and machine flat.



**Figure 21. Holes in gearbox must have the surrounding O-ring grooves welded up and machined smooth**

- f. Clean all parts in solvent and dry.

## CAUTION

**Chemical hazard and inhalation hazard exists if the appropriate Personal Protective Equipment (PPE) is not used when using solvents and compressed air. When working with chemicals, avoid contact with them and ensure proper ventilation is adequate. Ensure all required PPE is used. Follow all local rules and regulations when working with chemicals. Failure to use proper PPE and to avoid chemical contact could cause a chemical hazard and inhalation hazard resulting in personal injury.**

- g. Check all machined parts for cleanliness, burrs, etc. Clean/deburr, if required.
- h. Be sure to flush all oil passageways to eliminate any debris from causing a gear or bearing failure.

- i. Install a new oil filter element and breather filter element as listed on illustration "HPD GEARBOX COMPONENT SPECIFICATIONS").
- j. Lubricate all gears, splines, and bearings prior to installation.
- k. Check to ensure that all parts are available and gathered at assembly area.

## Assembly and Shimming for Proper Bearing Endplay

- a. Install three .020 shims (.060 total) to bearing output housings on the side opposite of the input shaft of the gearbox. Refer to figures below.



**Figure 22.** Three .020 shims to be installed to rear output bearing housing



**Figure 23.** Installation of shims (.060) to rear output bearing housings

- b. Apply LUBRIPLATE 630-AA assembly grease (or equivalent) to the O-rings before installing to the output bearing housings.

### Lubriplate 630-AA Specifications

Type of soap	Lithium
N.L.G.I. #	1
Worked penetration range @ 77° F (25° C)	300/330
ASTM dropping point, °F	380
Mineral oil viscosity SUS @ 100° F (38° C)	750
Non-corrosive extreme pressure & lubricity additives	YES
Water resistant	YES
Color	OFF-TAN



**Figure 24.** Installation of O-ring to rear output bearing housing

- c. Apply LUBRIPLATE 630-AA assembly grease (or equivalent) to the O-ring and to the openings in the gearbox for the bearing output housings as shown below.



**Figure 25. Application of assembly grease to gearbox**

- d. Hoist the first gear and bearing assembly into the gearbox.  
 e. Replace any socket head capscrews with SAE Grade 8 bolts.  
 f. Verify that the proper washers (.217" thick and hardened) are used under the bolts.  
 g. Align the gear and bearing assembly with the bearing output housing.  
 h. Install the output housing retaining bolts and flat washers. The threads on these bolts must be sealed to prevent oil leaks.



**Figure 26. Installation of rear output bearing housing**

## NOTICE

**DO NOT lubricate these bolts with 30W motor oil or any other lubricant. Do not apply Teflon tape, Teflon based thread sealant or any thread locking compound.**

**Apply 410-3739 LOCTITE RC 569 Hydraulic Thread Sealant compound to the threads.**

**Torque the bolts to 361 ft lbs (489 N•m).**

- i. Leave the gear and bearing assembly suspended from the hoist so that it can be positioned into the front output bearing housing.
- j. Install .040 shims to the front output bearing housings.

## NOTICE

**Shimming is done from the front side of the gearbox. DO NOT install O-ring at this time. The .040 shims are a starting point to use to calculate whether shims need to be added or removed to get bearing endplay to within the allowable tolerance of .004 to .006. The front output bearing housing must be removed for final placement of the shims and then reinstalled with the O-ring in place.**

- k. Lubricate the gearbox opening for the bearing output housing with LUBRIPLATE 630-AA assembly grease.
- l. Place the bearing output housing into the opening and use the hoist to position the gear and bearing assembly into the output bearing housing with the bearing seated in the race.



**Figure 27. Installation of front output bearing housing with .040 shims in place**

- m. Install the retaining bolts at this time with no lubricant or thread sealer on the threads. Use a ½" impact, set on high, with 120 psi air pressure. This will provide approximately 315 lbs. of torque. Use of a torque wrench is not required at this stage of the assembly.
- n. Install all gears in the same manner.
- o. Install the brace bars, then torque bolts and self-locking nuts to 282 ft lbs (382 N•m).

## NOTICE

**The brace bars must be assembled in the proper location or the oil gallery rail will not fit properly.**



**Figure 28. Installation of brace bars**

- p. Place a magnetic base dial indicator on the backside of the gearbox with the probe against the inside bearing race.



**Figure 29. Magnetic base dial indicator in position to read bearing end play**

- q. From the front of the gearbox, place two pry bars on each side of the top front side of the first gear and pry the gear towards the rear of the gearbox.



**Figure 30. Gear pried toward rear of gearbox**

- r. Hold the gear with the pry bars while a second person zeros the dial indicator.

- s. Move to the rear of the gearbox. Place the pry bars in position to pry the gear towards the front of the gearbox.



**Figure 31. Gear pried toward rear of gearbox to measure bearing end play**

- t. Have the second person read the dial indicator and record the reading.
- u. Remove the front output bearing housing and place the appropriate shims to get the bearing endplay to within .004 to .006.



**Figure 32. Removal of front output bearing housing for shim adjustment**

## NOTICE

**This may require more than one removal and installation of the bearing output housing with different thicknesses of shims before the final allowable endplay is reached.**

**When the front output bearing housing is removed to adjust the shims, it is essential to either have a second person hold the gear and bearing assembly or place suitable blocking between the gear and the gearbox housing to prevent the gear and bearing assembly from falling forward out of the rear output bearing housing. The gear and bearing assembly must be held in this position until the front output bearing housing is reinstalled.**

- v. Reinstall the output bearing housing and recheck the bearing endplay. If it is not within the allowable tolerance of .004 to .006 remove the output bearing housing and adjust the shims as needed and replace the output bearing housing and check endplay again.
- w. Once the correct shims have been determined, remove the output bearing housing and install the O-ring. Lubricate the O-ring and opening in the gearbox with LUBRIPLATE and install the output bearing housing.
- x. Install the bolts with LOCTITE RC569 thread sealant compound on the threads of the retaining bolts. Torque to 361 ft lbs (489 N•m).
- y. Repeat this procedure for each gear assembly.

## NOTICE

Perform the complete shimming procedure for each gear. The first gear shims may not be the same required for the other gears.

- z. After shimming each gear and bearing assembly, turn the gears by hand. They should turn freely with no binding.

### Installation of Manifold Tube Assembly

## NOTICE

Some gearboxes were equipped with an improperly manufactured manifold tube structure assembly which had straight 1/4" O.D. tubes. The correct manifold tube structure assembly has curved 1/4" O.D. tubes that deliver oil to the bearings in a more efficient manner by extending into the hole above the bearing. The only straight tube is located over the input shaft. The entire manifold assembly must be replaced if it is necessary to change to the curved 1/4" tubes. The curved 1/4" O.D. tubes cannot be installed on the manifold originally equipped with straight 1/4" O.D. tubes.

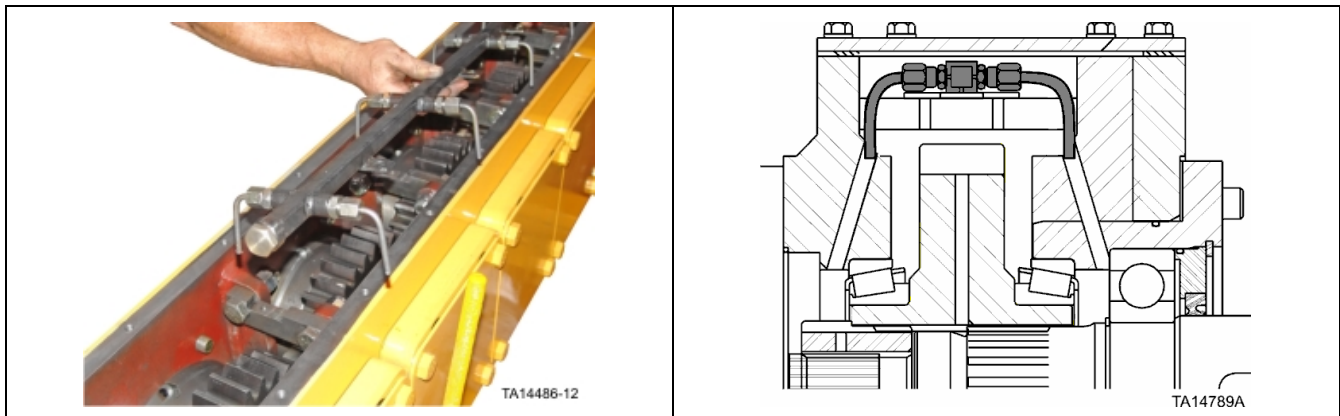


Figure 33. Incorrect manifold tube assembly with straight tubes

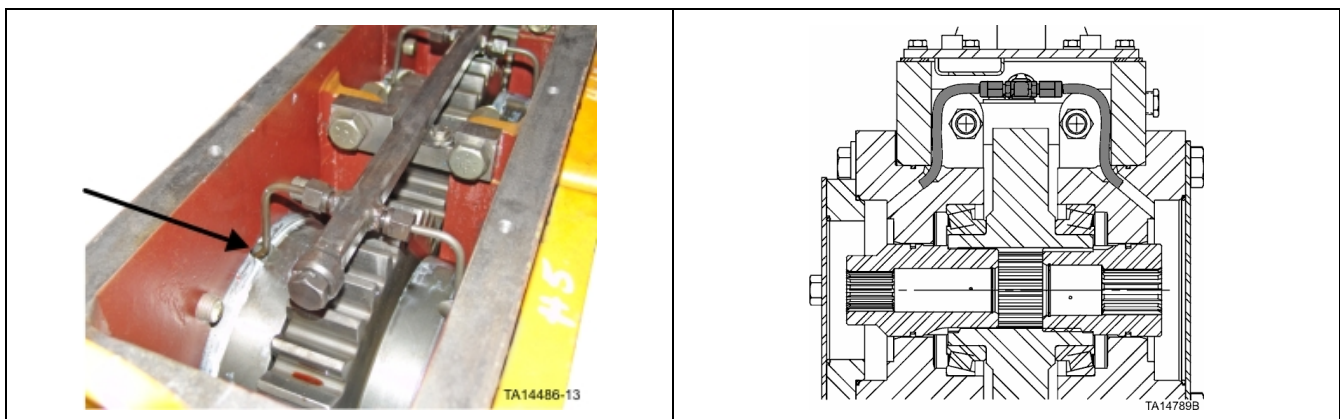


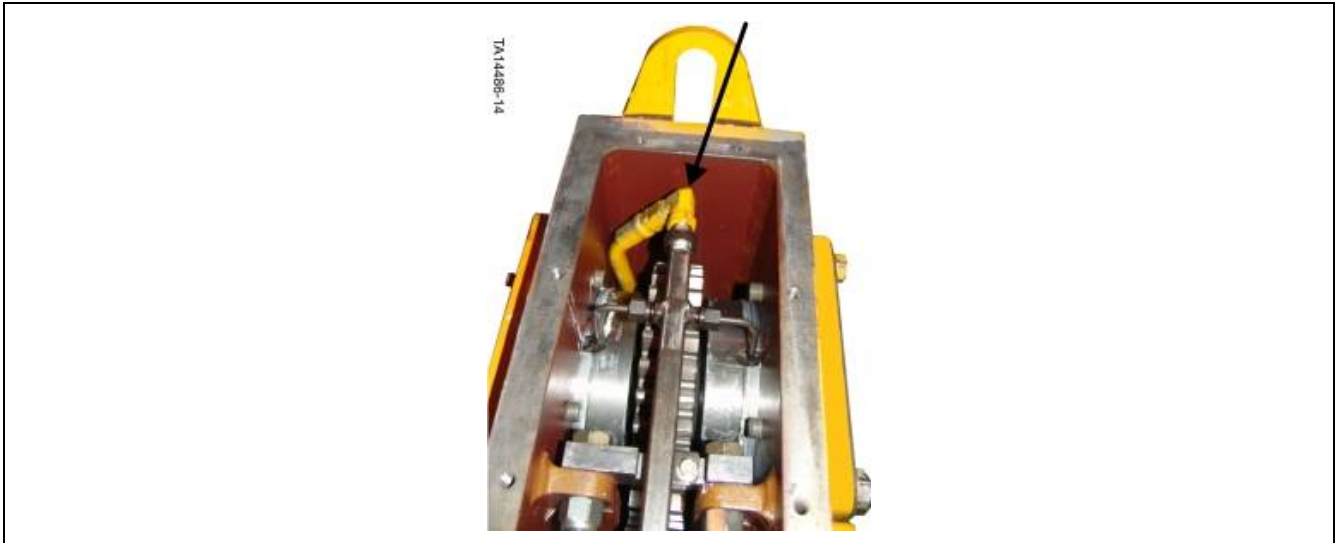
Figure 34. Correct manifold tube assembly with curved tubes

- a. Install manifold tube structure assembly.

## NOTICE

Some gearboxes were equipped with a steel supply tube to the manifold assembly. The supply line is a hose on current gearboxes as shown in figure below. It is not necessary to change this tube unless it is leaking or damaged.

- b. Install hose to manifold tube assembly. It is critically important that the 90° fitting is attached and tightened to the manifold tube assembly so that the hose cannot make contact with the gear. Refer to illustration below.

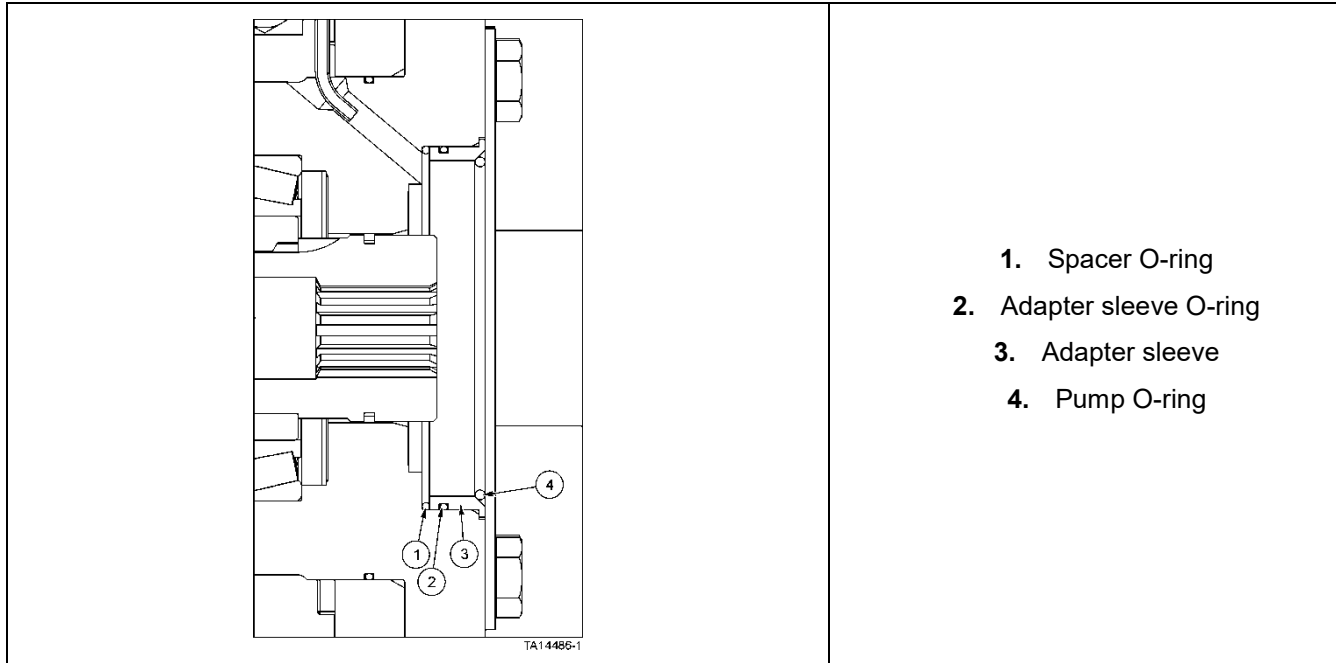


**Figure 35. Correct hose installation to manifold tube assembly to avoid damaging hose**

- c. Install the lid on the box. Do not use RTV sealant on the gasket for the lid as it can come loose and clog filter and oil passages.

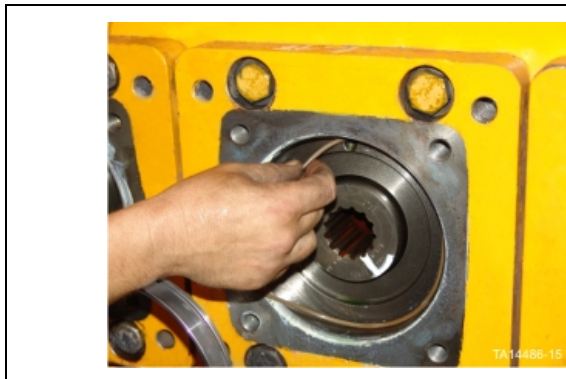
## Installation of O-Rings and Spacer O-Ring

Two of the pumps have a smaller pilot diameter than the gearbox bearing housing so adapter sleeves (#3 below) are used. Two new O-rings (#1 and #2 below) are needed to seal each adapter sleeve (one in the center OD O-ring groove of the adapter and one as a spacer in the bore of the bearing housing where the adapter seats). The pump O-ring (#4 below) fits the pilot bore and seals against the chamfered edge of the adapter.

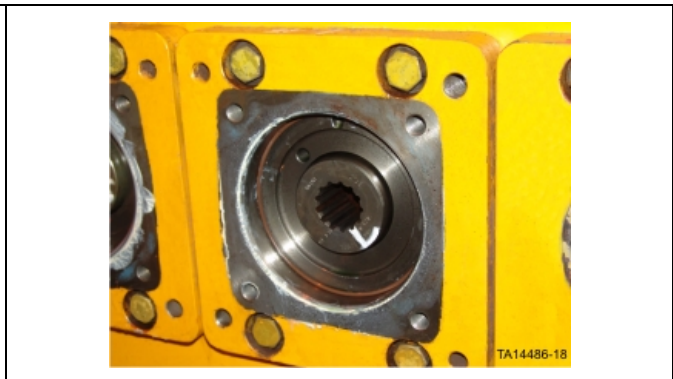


**Figure 36. Side view illustration of sleeve installation with spacer O-ring**

a. Place O-ring into output bearing housing as shown.



**Figure 37. Installation of spacer O-ring into output bearing housing**



**Figure 38. Completed installation of spacer O-ring.**

- b. Install O-ring to sleeve and apply LUBRIPLATE 630-AA assembly grease to the O-ring and sleeve.



**Figure 39. Application of assembly grease to sleeve O-ring and sleeve.**

- c. Place the sleeve square into the opening in the output bearing housing.



**Figure 40. Placement of sleeve square into output bearing housing.**

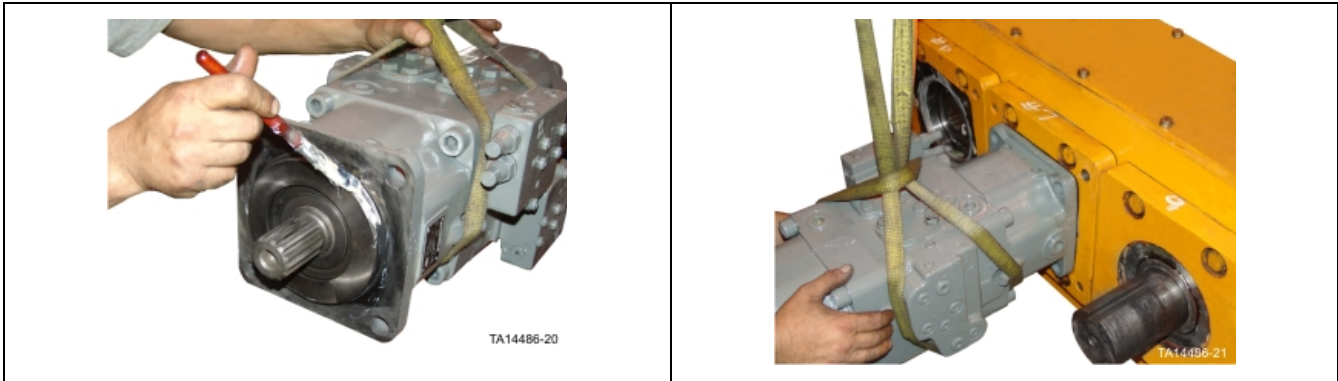
- d. Use a rubber mallet to drive the sleeve into the housing against the O-ring. The outer edge of the sleeve should be flush with the outer face of the output bearing housing.



**Figure 41. Installation of sleeve into output bearing housing**

- e. Install O-ring to the pump and apply LUBRIPLATE 630-AA assembly grease to the O-ring.

- f. Attach a sling to the pump and hoist the pump into mounting position on the output bearing housing.



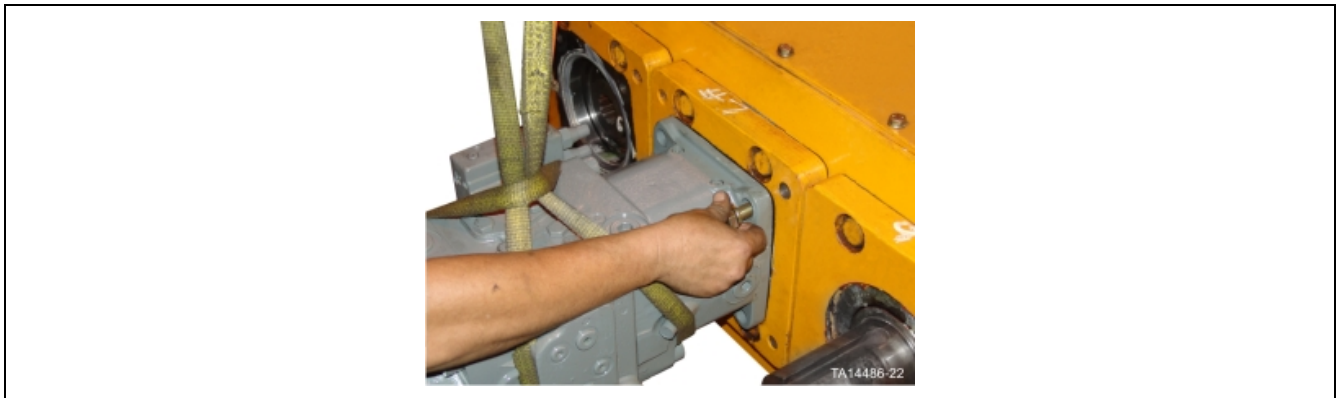
**Figure 42.** Application of assembly grease to pump O-ring and pump.

**Figure 43.** Installation of pump to gearbox.

## NOTICE

There will be a slight gap between the pump and the face of the output bearing housing when the pump is first put into mounting position. Installation of the pump retaining bolts will close this gap and provide proper sealing of the pump to the gearbox.

- g. Lubricate pump retaining bolts on the threads and under the heads with 30W motor oil. Install retaining bolts and flat washers and torque to 361 ft lbs (489 N•m)



**Figure 44.** Installation of pumps retaining bolts & flat washers

# Installation and Alignment of Gearbox to Generator

## Safety Preparations

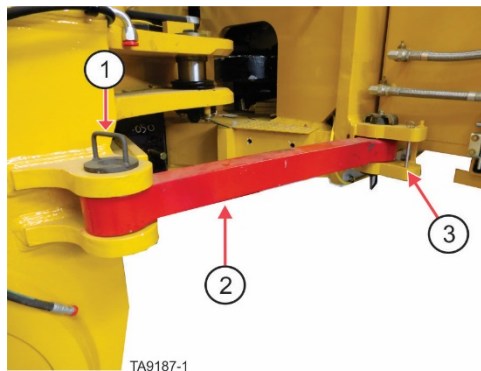
### WARNING

Crush hazards exist if the machine is started or moved while work processes are being performed on the machine. Place bucket flat and level on the ground. Place frame lock in the locked position and lock out the machine's starting capability before performing any work process. Follow all applicable lockout procedures and local rules and regulations for performing work processes. ANYONE performing inspections or service procedures to the machine should be familiar with ALL instructions and procedures contained in the machine's SERVICE MANUAL. Crush hazard could occur if the machine is started or moves while any type of work process is being conducted on the machine, resulting in serious injury or death.

- a. Ensure the bucket is empty and clear of debris.
- b. Park the machine in the wash bay with the bucket flat on the ground.
- c. Move the frame lock to the locked position so that the frame cannot be steered.
- d. Place wheel chocks in front and behind each wheel.

### WARNING

Crush hazards exist in machine pivot area and area between the tires. Do not enter these areas unless it is verified that the operator has control over the steering and that personnel locking the frame lock have good communication with the operator. Entering the pivot area and area between the tires while the machine is moving or pivoting (articulating) could cause crush hazards resulting in serious injury or death.



**Frame lock in locked position**

- 1) Retaining pin for locked position, 2) Frame lock - shown in locked position,  
3) Retaining pin bracket for un-locked position

**Figure 45. Frame Lock**

- e. Set bucket flat and level on the ground.
- f. Set the parking brakes.
- g. Shut off the engine.

## ⚠ WARNING

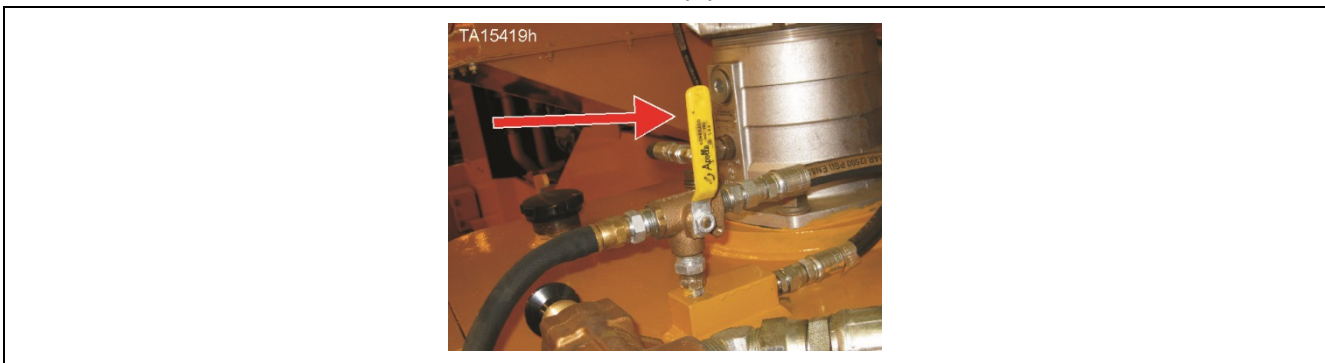
Crush, shock, or other hazards exist if stored energy is not removed or isolated prior to working on the machine. Stored energy (hydraulic, electrical, pneumatic, mechanical, etc.) may be present if not isolated or released prior to working on the machine. Do not work on the machine without removing this stored energy (suspended loads, electrical power, air pressure, etc.). Risk of crushing, shock, or other physical injury exists if stored energy is not removed or isolated prior to working on the machine which could result in serious injury or death.

- h. Turn the battery and engine isolation switches to the off position and install locks on the battery isolation switch.



**Figure 46. Battery Isolation Box – Battery isolation switch in OFF position with locks in place**

- i. Release the air from the hydraulic reservoir by using the hydraulic reservoir air valve (ball valve) on top of the reservoir. The supply line from main air system will be blocked and reservoir air will vent out the hose that runs down the outside of the hydraulic reservoir.
- Turn the handle to the up position as shown



**Figure 47. Hydraulic reservoir air valve handle UP**

- j. Release the air from the various air storage reservoirs by opening all of the air bleed valves.

Three valves on right side of rear frame under hydraulic reservoir
One valve on right side of front frame near hoist cylinder ball cap

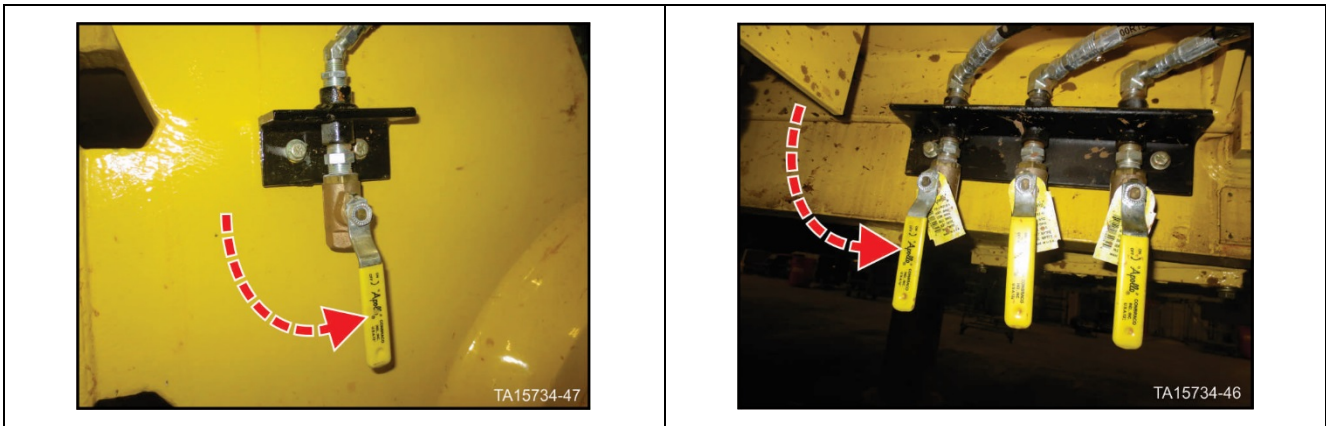


Figure 48. Open air reservoir bleed valves

**⚠ WARNING**

Crush hazards exist if all personnel are not cleared from the bucket and lift arm area before using the hydraulic hoist and bucket hydraulic pressure bleed down valves to relieve pressure from the hoist and bucket circuit. Clear all personnel from the area around the bucket and lift arms before operating hydraulic hoist and bucket hydraulic pressure bleed down valves. Using the hydraulic bleed down valves could result in some movement of the lift arms and bucket which could cause a crush hazard resulting serious injury or death.

- k. Use the hydraulic pressure bleed down valves located in the front frame underneath the Husco valves to bleed any stored pressure in the hoist and bucket cylinders.
- l. Turn each valve slowly counterclockwise as shown below and allow the pressure to bleed down.
- m. Open the valve completely and leave it open during the repair of the manifold.

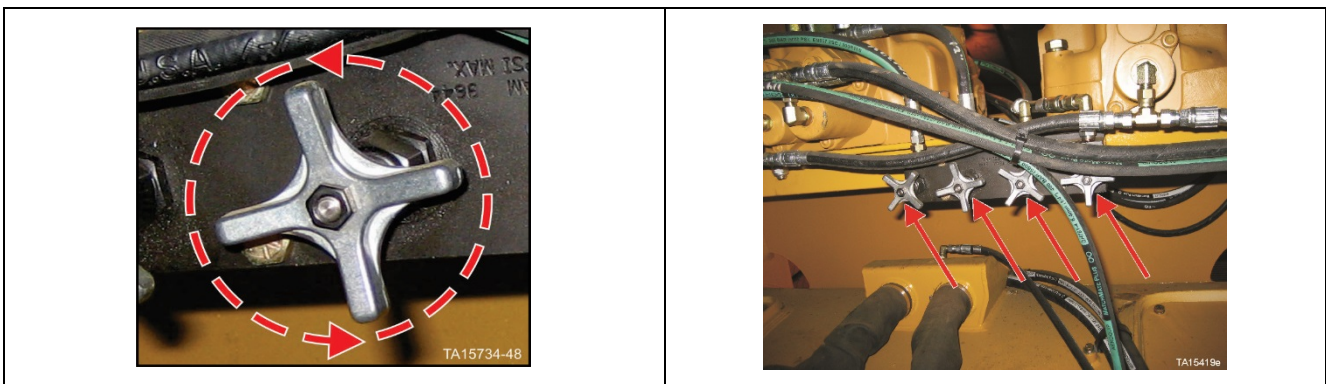


Figure 49. Pressure bleed down valves

## Installation

Refer to illustration "HPD gearbox assembly".

- a. Hoist gearbox into mounting position in machine.
- b. Fill HPD gearbox with recommended oil

Model	Component	Capacity		Lubricant
L1350/L1850/L2350	Hydraulic Pump Drive Gearbox <sup>2</sup>	7 gallons	27 liters	SAE 75W-140W synthetic gear oil or SAE 80W-90W gear oil.
1 ARCTIC CONDITIONS represent a specialized field where extensive use is made of heating equipment before starting.				
2 Refer to Section 3 of this manual. The hydraulic pump drive gearbox is factory equipped with synthetic oil.				

- c. Attach gearbox mounts to machine with bolts and washers.

## CAUTION

**Extreme caution must be exercised to ensure proper alignment of the gearbox to the generator or component damage could occur. Refer to illustration "L1350/L1850/L2350 HPD gearbox drive shaft installation".**

- d. Install the drive hub on the generator output shaft.

## NOTICE

**INSULATED COMPONENTS – It is CRITICALLY IMPORTANT to install insulated components as shown in illustration "Generator insulated components". Note that the laminated retainer key has a specific installation orientation. When installed in the proper orientation, the material is approximately the same strength as a steel key. Orientation of all insulated components is further illustrated in "Installed components cross section".**

**Before beginning the alignment process, the diameters of the drive and driven hubs must be determined. Because of manufacturing tolerances, the hubs could be of different diameters. If different, allowance must be made for the alignment tolerances.**

**Before beginning alignment process, refer to "Alignment and Misalignment", following this procedure.**

- e. Install the driven hub on the gearbox input shaft.
- f. Attach hoisting device to lifting eyes and hoist gearbox into mounting position.
- g. Temporarily place the driveshaft between the drive hub and the driven hub to assure proper clearance. (for L1350 Generation 2, skip to step i)
- h. Move the drive shaft until the hubs are aligned.
- i. Place a straight edge, of adequate length, over the top of each hub in the 12 o'clock position (refer to illustration "HPD gearbox alignment").
- j. With a feeler gauge, check under the straight edge.
- k. Adjust the gearbox vertically by screwing in or out on the bolts in the adjusting bars until there is 1/32" clearance or less at the 12 o'clock position. (Allow for manufacturing tolerances previously discussed in NOTICE above.)
- l. Next, place the straight edge over the side of each hub at the 3 or 9 o'clock position.

- m. Adjust the gearbox laterally by repositioning the mount structures to obtain 1/32" (0.79375 mm) or less clearance at either the 3 or 9 o'clock position. (Allow for manufacturing tolerances previously discussed in NOTICE above.)
- n. Recheck the 12 o'clock position to make certain that the original tolerance is maintained.
- o. Install the gearbox mount bolts. Torque bolts to Grade 8 specifications per the "Capscrew and Bolt-Nut Torque Specifications".
- p. Lift the drive shaft into position and move the driven hub until it meets with the drive shaft end. Secure the driven hub in place.
- q. Secure the U-joint bolts into the drive hub and driven hub. Tighten the bolts to 90-ft. lbs. (122 N•m), lubricated with 30-W motor oil on the threads and under the heads.
- r. Double check the alignment by placing the straight edge at the 12 and 3 or 9 o'clock positions, to ensure the original tolerances were maintained. Adjust if required.

## Completing the Installation

- a. Attach hoisting device to lifting eye on the KLENZ™ filtration unit and blower assembly, and then hoist assembly into position.
- b. Reinstall mount bolts, nuts and washers that secure blower assembly to adapter structure and air filtration unit to mount structure. Torque bolts, to Grade 8 specifications, per the "Capscrew and Bolt-Nut Torque Specifications".
- c. Install flex duct and hose clamp between filter assembly and blower assembly.
- d. Reconnect all hoses to applicable pumps.
- e. Reconnect hydraulic lines to blower motor.
- f. Refill the hydraulic reservoir to the full mark on the reservoir sight gauge. Refer to Section 04 for instructions on filling the hydraulic reservoir.
- g. Close manual air release valve on top of hydraulic reservoir.
- h. Bleed all hydraulic pumps.

## CAUTION

**Failure to bleed each hydraulic pump following service or repair of the hydraulic system can result in pump failure or shortened pump life due to a dry-start condition at machine start up.**

- i. Recheck flex hose and clamp, between blower and filter assembly, for leaks.
- j. Reinstall the front hood structure.
- k. Reinstall crossmember that anchors grating.
- l. Reinstall grating.
- m. Enable machine's starting capability with the starter isolation switch and start engine.
- n. Check all hydraulic pumps and blower motor for hydraulic fluid leaks with engine at HI throttle.
- o. Check for gearbox oil and hydraulic oil leaks.
- p. Check all clamps and air ducts for proper positioning and air leaks.
- q. Move frame lock to unlocked position.
- r. Follow local rules and regulations to return the machine to operating condition.

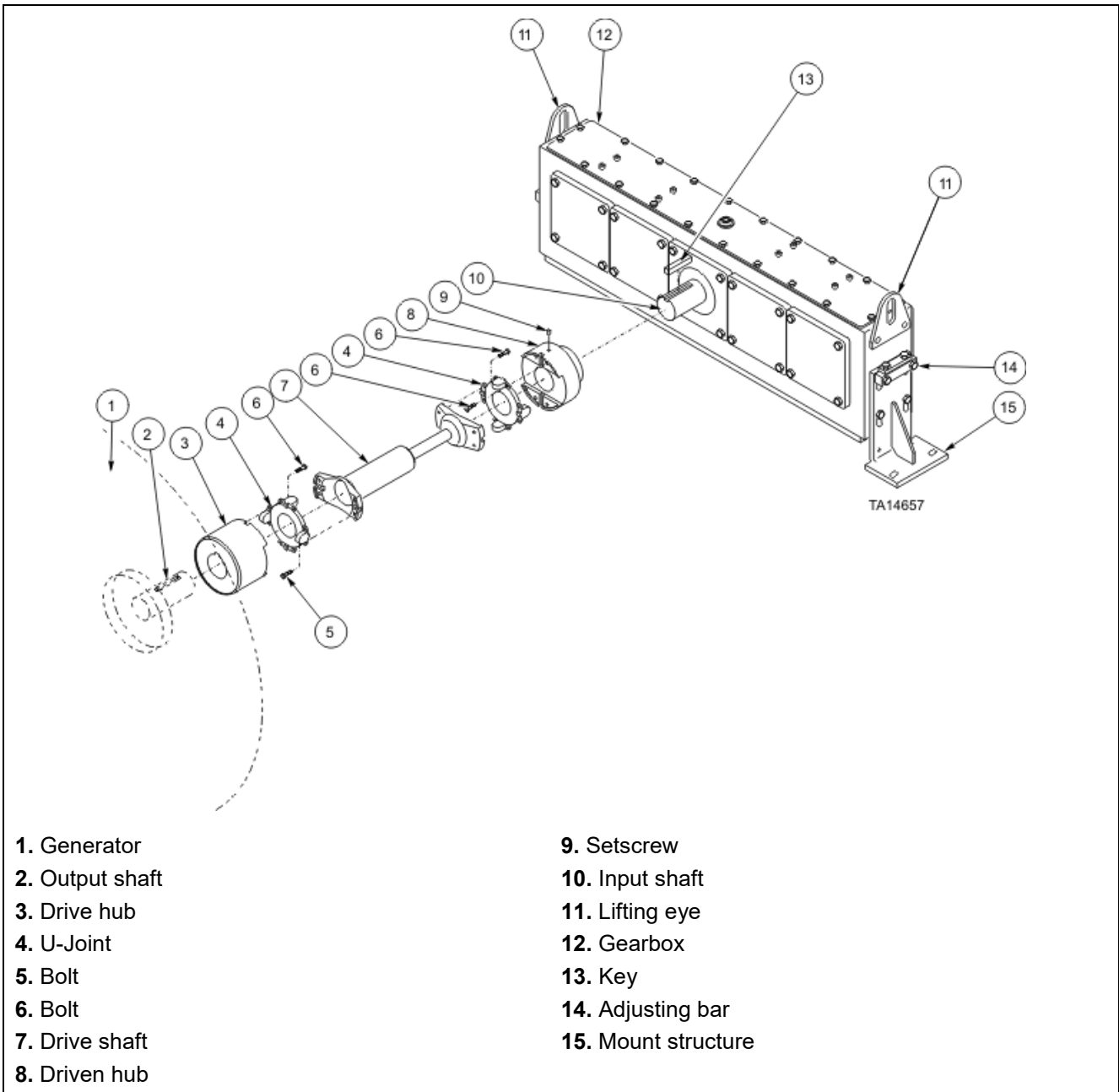
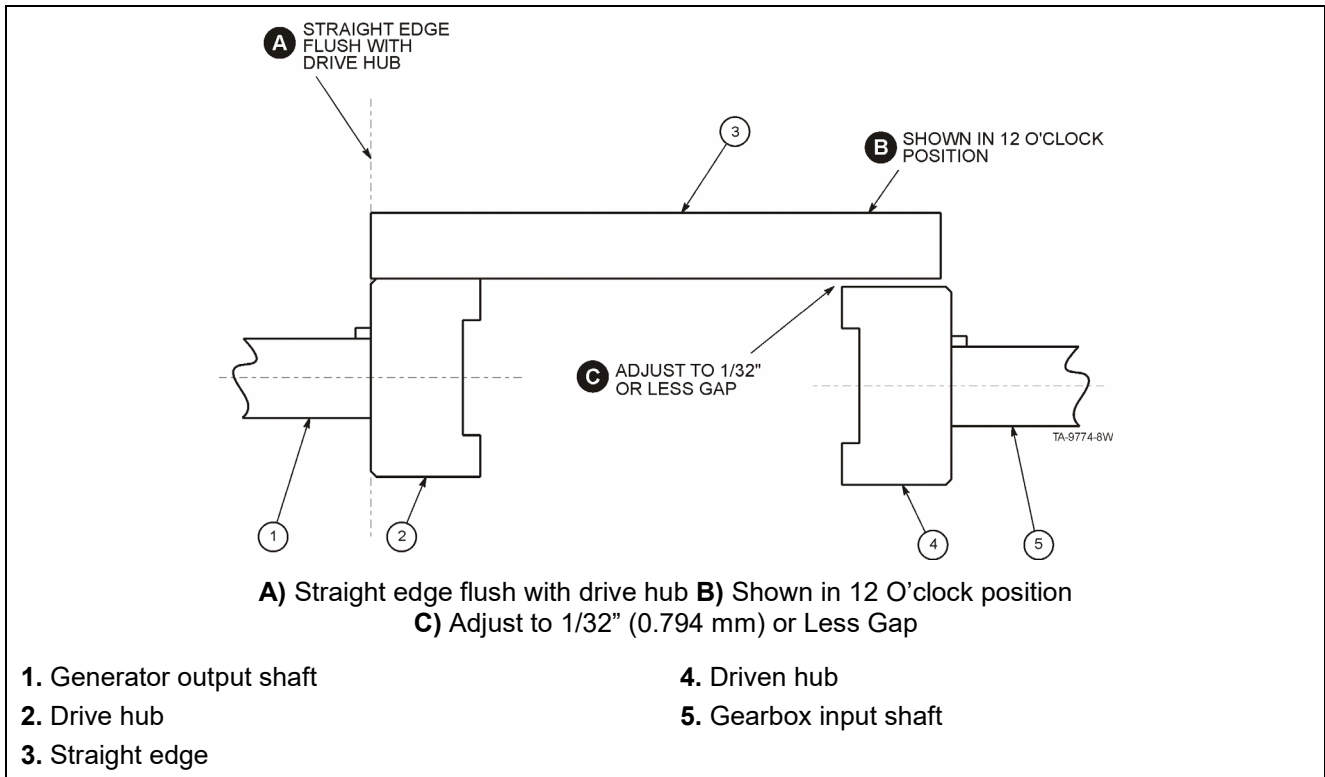
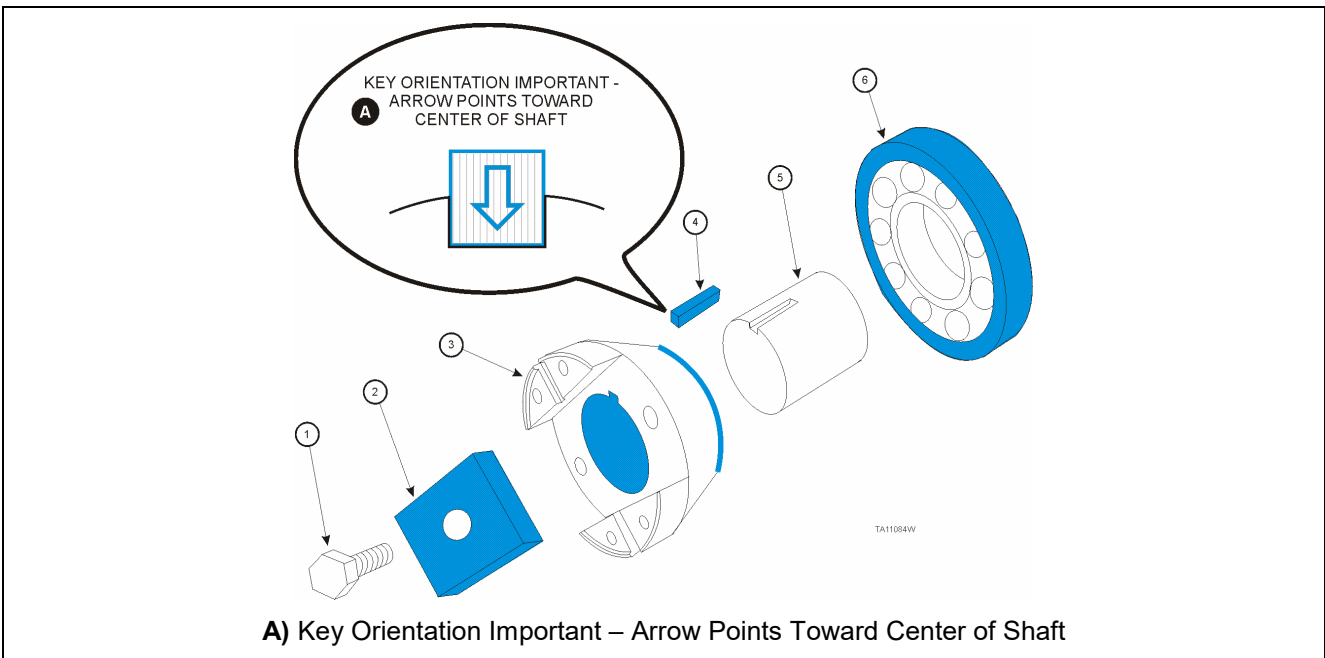


Figure 50. L1350/L1850/L2350 HPD gearbox drive shaft installation

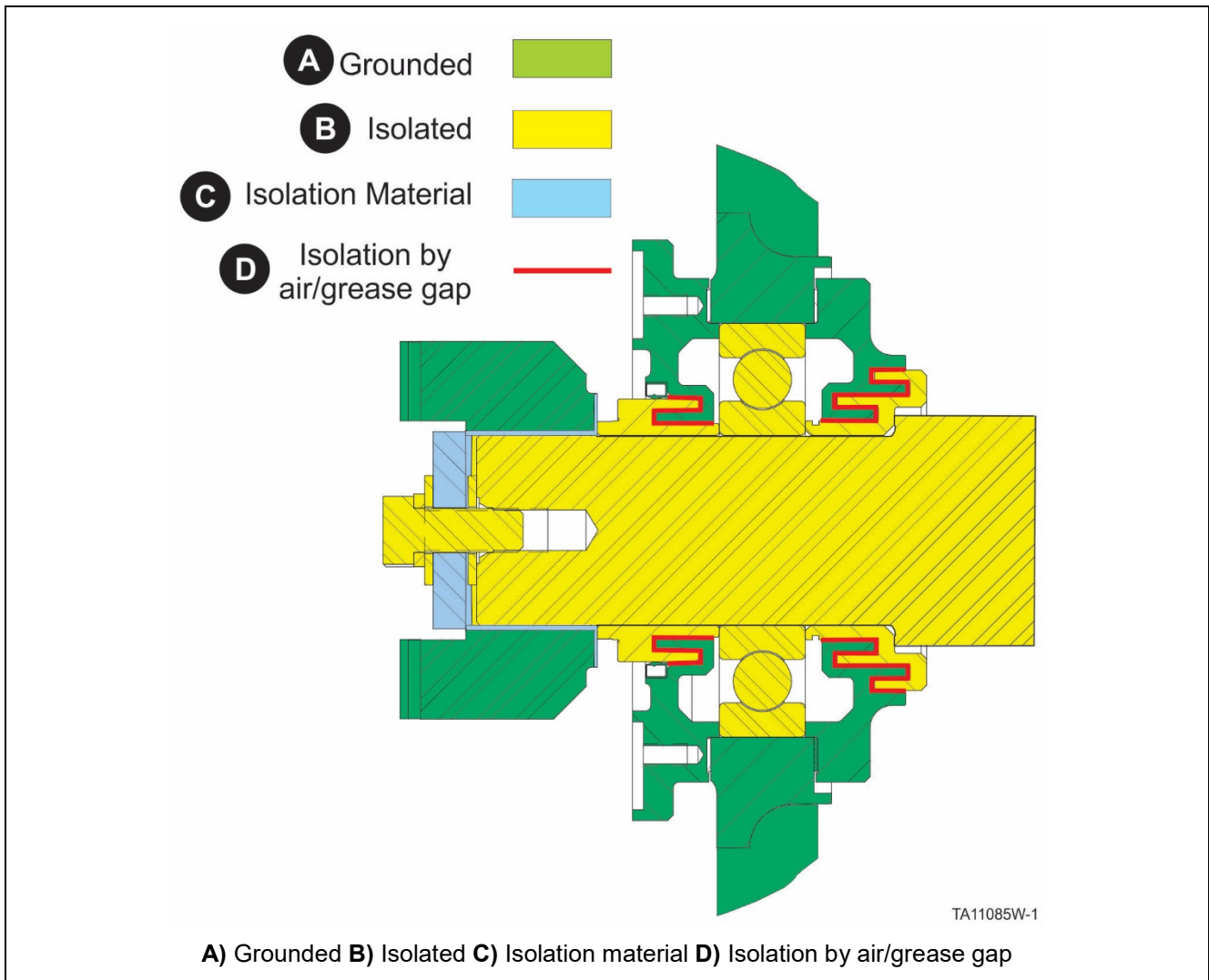


**Figure 51. HPD gearbox alignment**



- 1. Retainer bolt (Torque To 230 Ft/Lbs [311 N•M])
- 2. Insulated retainer plate
- 3. Insulated drive hub
- 4. Insulated retainer key
- 5. Generator drive shaft
- 6. Insulated bearing

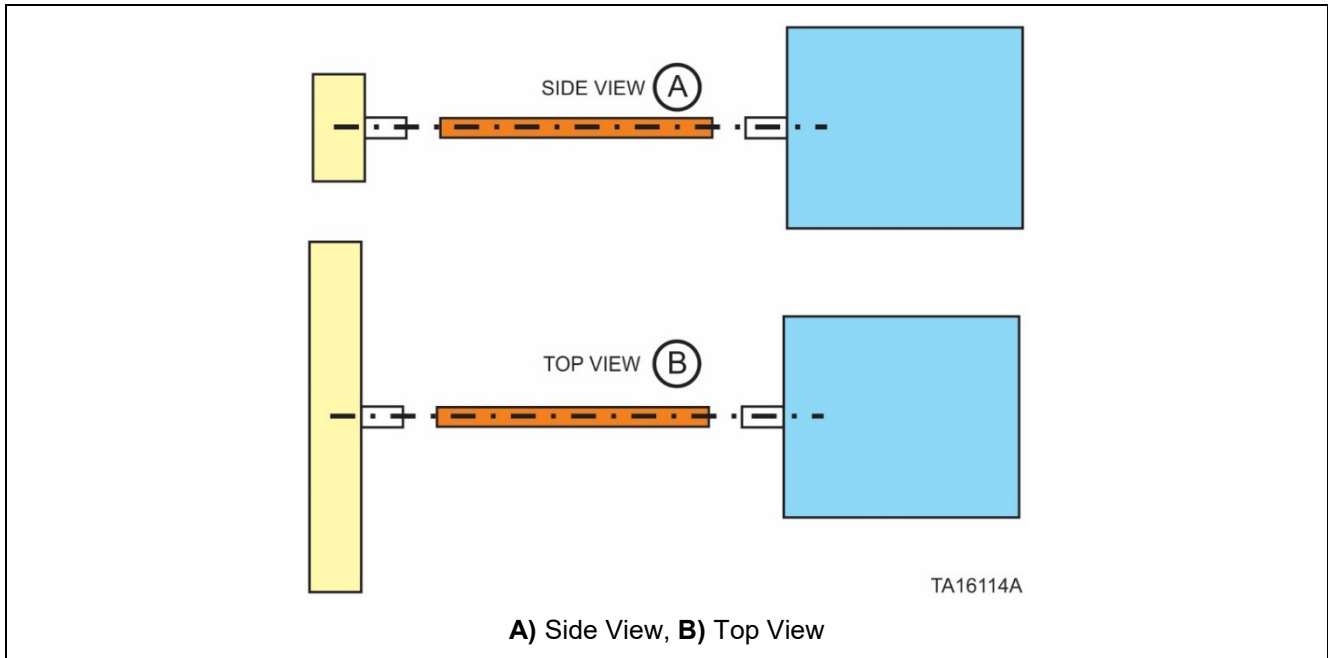
**Figure 52. Generator insulated components**



**Figure 53. Installed components cross section**

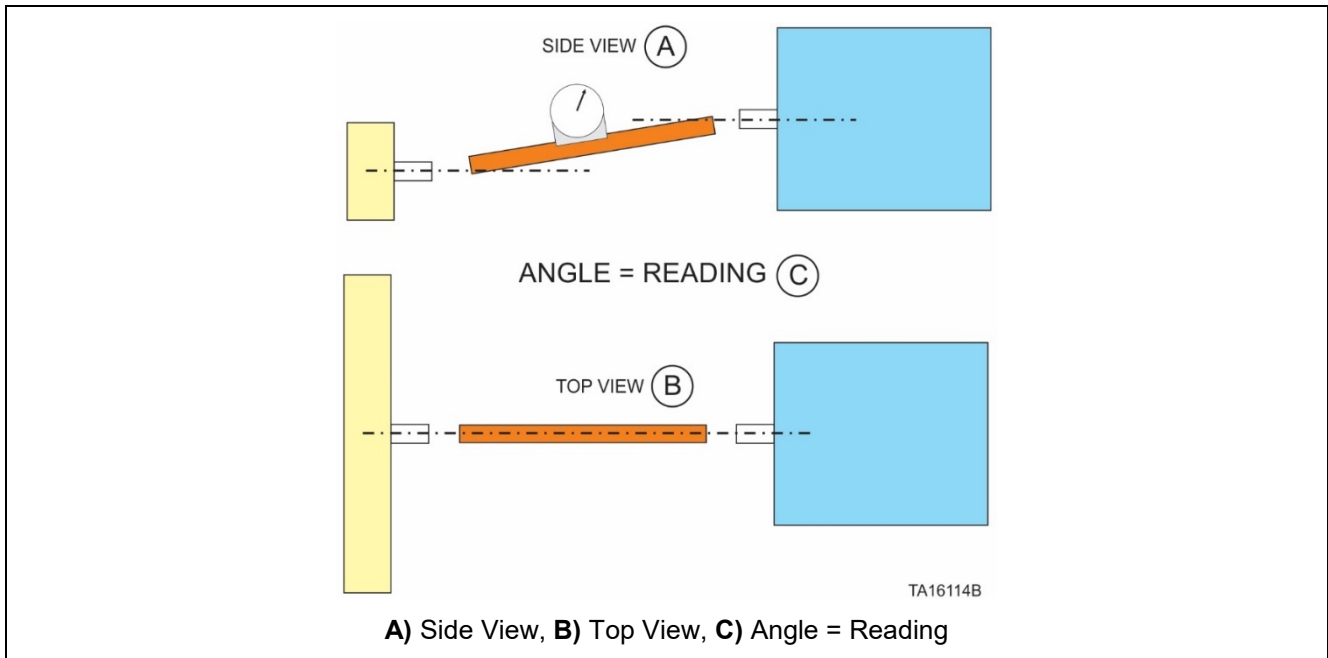
## Alignment and Misalignment

When the HPD gearbox and the generator are perfectly aligned, their horizontal shafts should be on the same centerline in all directions. Reference the illustration below.

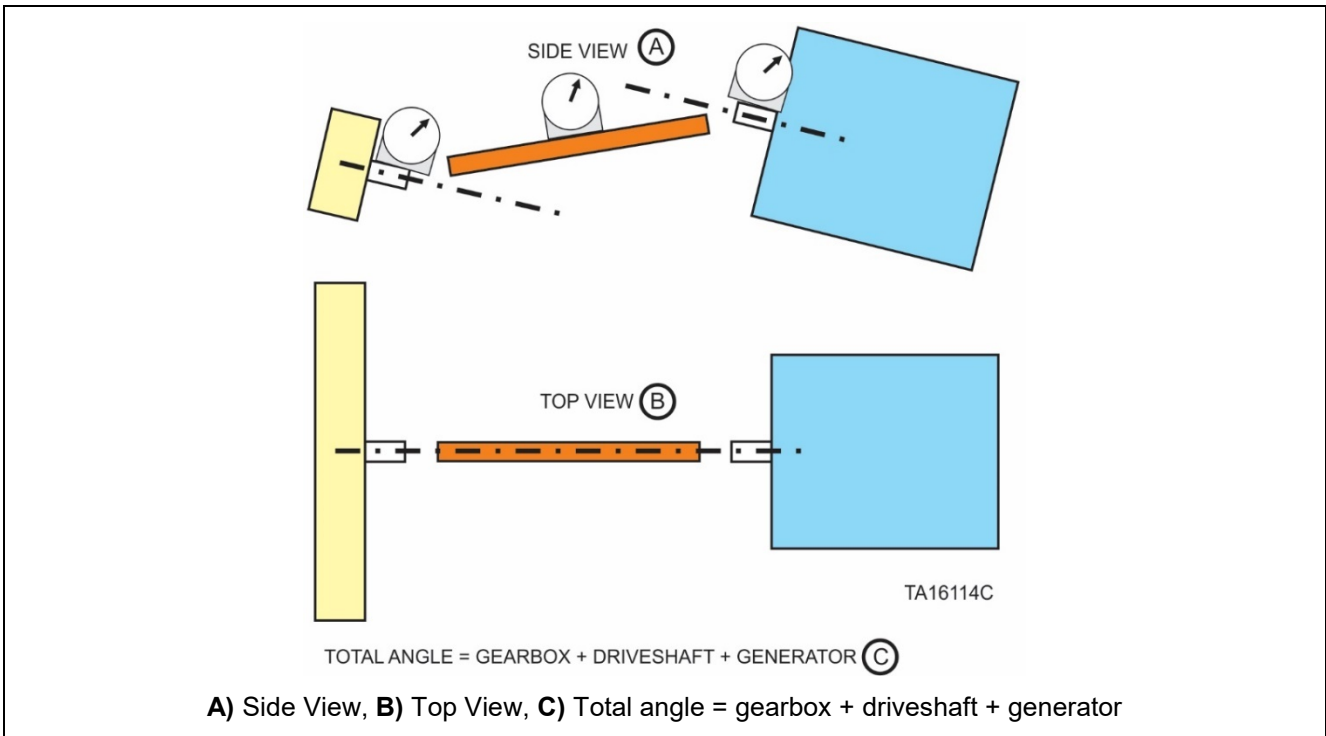


**Figure 54. HPD and generator shafts aligned properly**

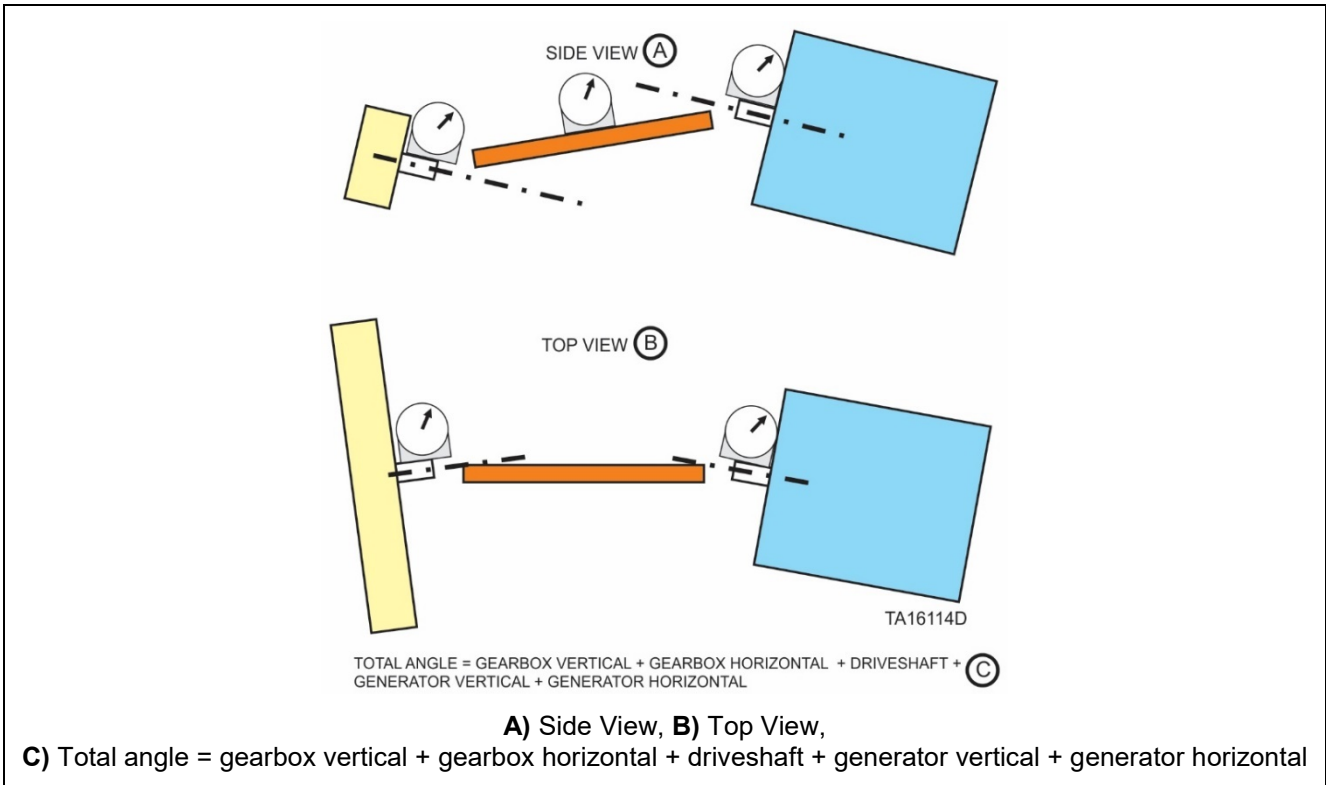
There are different types of misalignment. The following illustrations show some misalignment types that can occur.



**Figure 55. Vertical misalignment**



**Figure 56. Vertical misalignment with generator and gearbox not parallel**



**Figure 57. Vertical and horizontal misalignment with generator and gearbox not parallel**

Component Drawings

Exploded view drawing of the HPD gearbox and pumps 1350 GEN3. The drawing shows the main gearbox housing (1) with four pump assemblies (2) mounted on top. Various components like seals, O-rings, and test blocks are shown in their relative positions. A parts list on the right side of the drawing identifies each numbered component.

1	GEARBOX AND DRIVE ADAPTERS ASSEMBLY	67	SETSCREW
2	PUMP, PISTON	68	CAPSCREW
3	PUMP, VANE	69	LOCKWASHER
4	PUMP, PISTON	70	CAPSCREW
5	PUMP ASSEMBLY, VANE	71	BOLT
6	PUMP, PISTON	72	BOLT
7	PUMP, PISTON	73	CAPSCREW
8	HUB, DRIVEN	74	CAPSCREW
9	AIR COMPRESSOR	75	FLATWASHER
10	MANIFOLD, CASE DRAIN	76	FLATWASHER
11	FLANGE STRUCTURE, PUMP	77	LOCKWASHER
12	FLANGE STRUCTURE, PUMP	78	BOLT
13	FLANGE STRUCTURE, PUMP	79	BOLT
14	MOUNT STRUCTURE, GEARBOX	80	BOLT
15	COVER PLATE	81	BOLT
16	SEAL, QUAD RING	82	BOLT
17	O-RING	83	BOLT
18	O-RING	84	BOLT
19	O-RING	85	LOCKWASHER
20	SEAL, QUAD RING	86	BOLT
21	O-RING	87	FLATWASHER
22	O-RING	88	LOCKWASHER
23	O-RING	89	BOLT
24	O-RING	90	BOLT
25	SEAL, QUAD RING	91	NOT USED
26	TEST BLOCK	92	PLUG, PIPE
27	BLOCK, SPACER	93	CAPSCREW
28	TEST BLOCK		
29	TEST BLOCK		
30	FLANGE HALF		
31	FLANGE HALF		
32	TEST BLOCK		
33	FLANGE HALF		
34	ELBOW		
35	ADAPTER		
36	NUT, CAP		
37	PLUG		
38	PLUG, PIPE		
39	ELBOW		
40	ELBOW		
41	ELBOW		
42	ADAPTER		
43	PLUG		
44	TEE		
45	ELBOW		
46	ELBOW		
47	NOT USED		
48	NOT USED		
49	ELBOW		
50	NIPPLE, PIPE		
51	COUPLING, PIPE		
52	ADAPTER		
53	ELBOW		
54	ADAPTER		
55	ELBOW		
56	NIPPLE, PIPE		
57	TEE		
58	PLUG, PIPE		
59	ADAPTER		
60	BAR, ADJUSTING		
61	KEY		
62	WASHER		
63	FLATWASHER		
64	LOCKWASHER		
65	BOLT		
66	BOLT		

428-8366

Figure 58. HPD gearbox and pumps 1350 GEN3

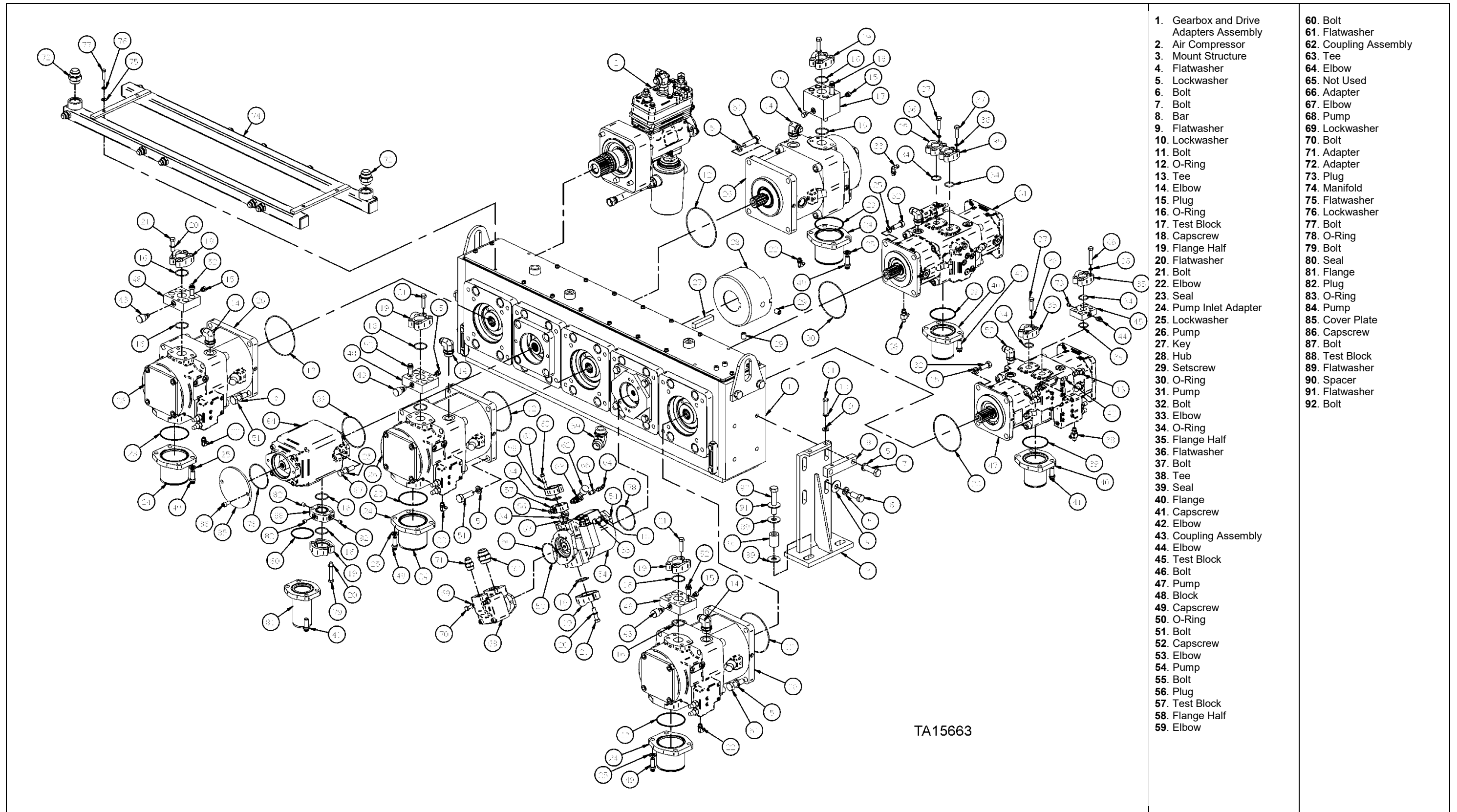
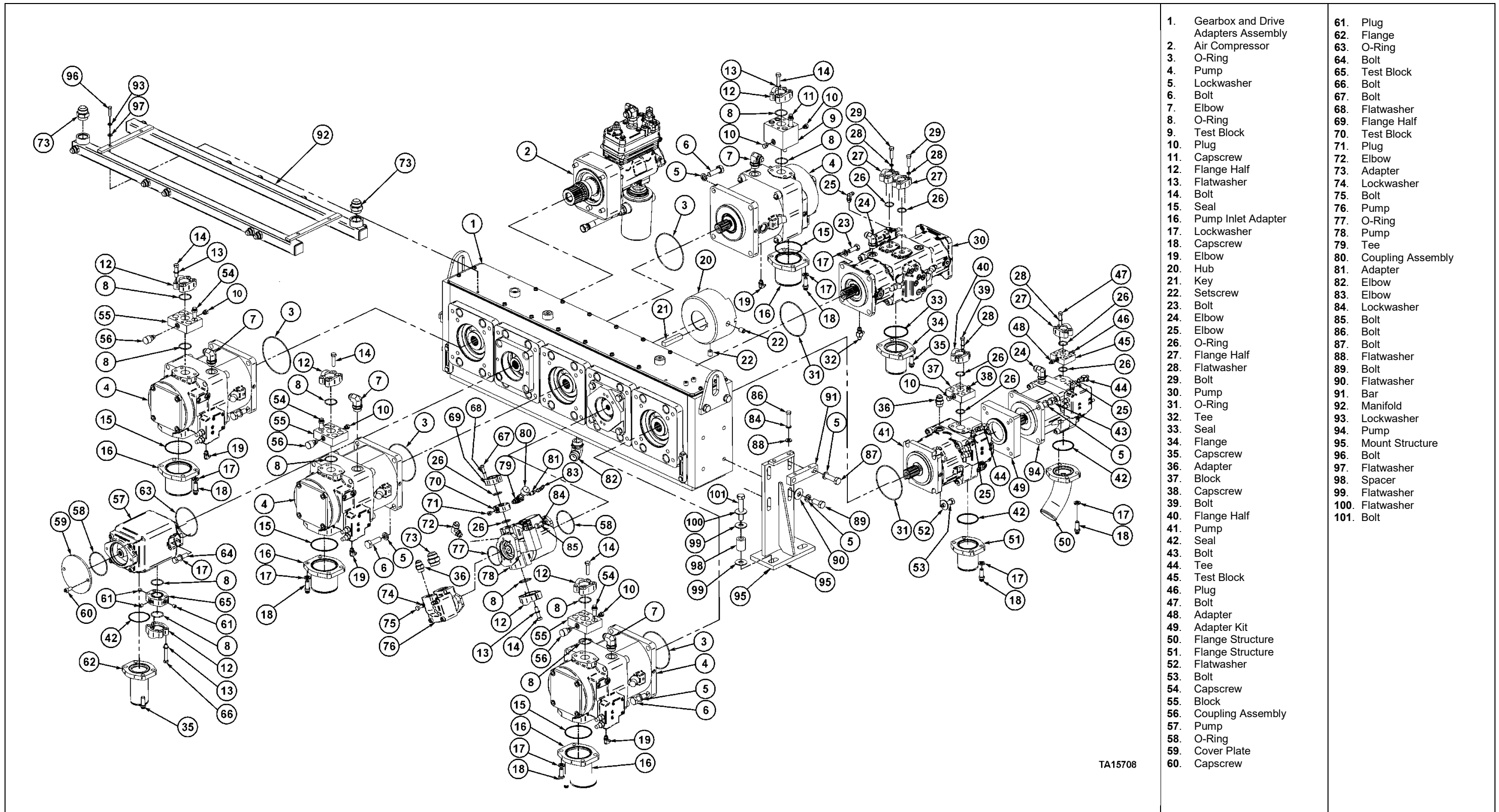


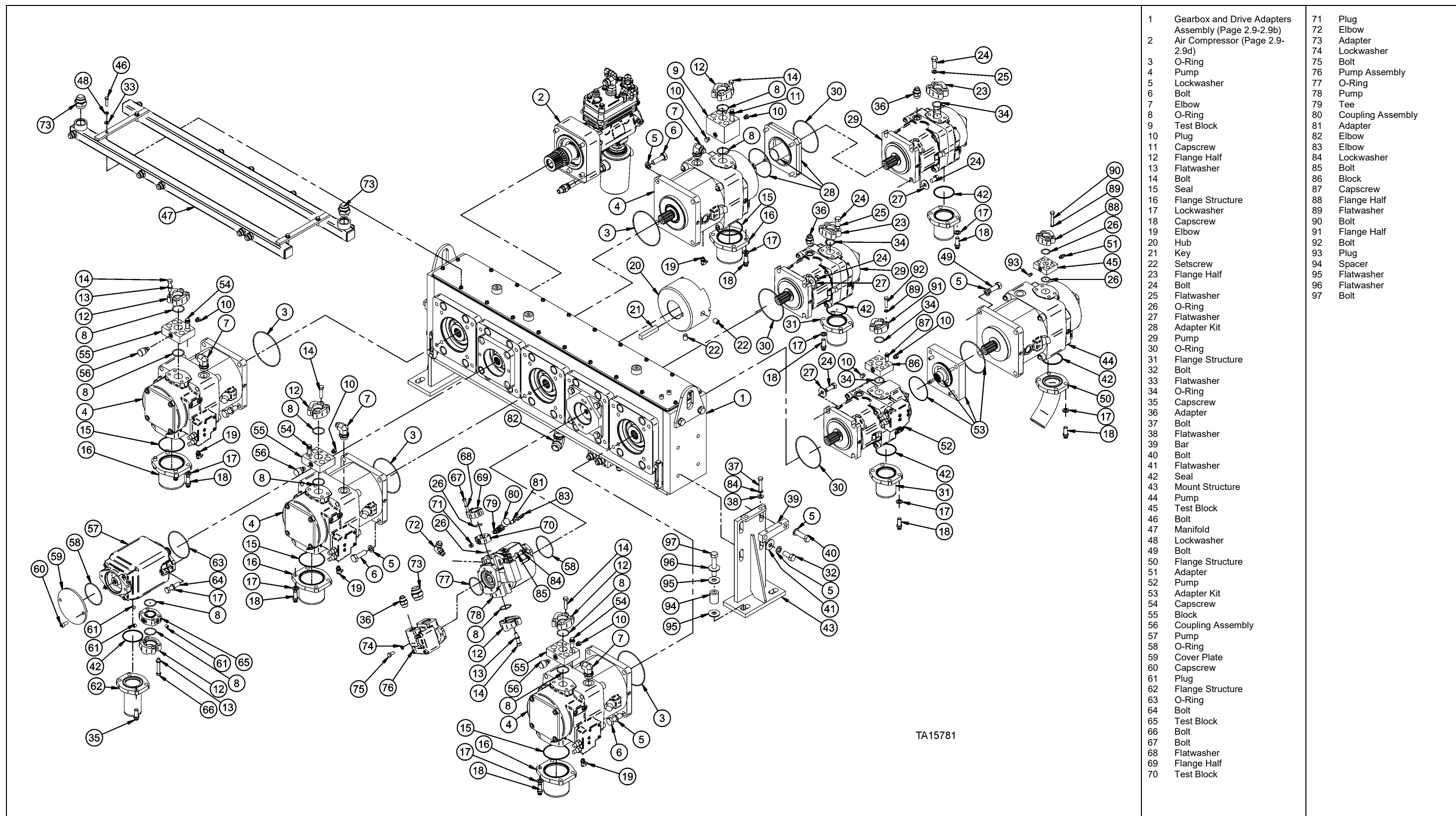
Figure 59. HPD gearbox and pumps Tier I (typical)



TA15708

- |  |                       |
|--|-----------------------|
| 1. Gearbox and Drive Adapters Assembly | 61. Plug              |
| 2. Air Compressor                      | 62. Flange            |
| 3. O-Ring                              | 63. O-Ring            |
| 4. Pump                                | 64. Bolt              |
| 5. Lockwasher                          | 65. Test Block        |
| 6. Bolt                                | 66. Bolt              |
| 7. Elbow                               | 67. Bolt              |
| 8. O-Ring                              | 68. Flatwasher        |
| 9. Test Block                          | 69. Flange Half       |
| 10. Plug                               | 70. Test Block        |
| 11. Capscrew                           | 71. Plug              |
| 12. Flange Half                        | 72. Elbow             |
| 13. Flatwasher                         | 73. Adapter           |
| 14. Bolt                               | 74. Lockwasher        |
| 15. Seal                               | 75. Bolt              |
| 16. Pump Inlet Adapter                 | 76. Pump              |
| 17. Lockwasher                         | 77. O-Ring            |
| 18. Capscrew                           | 78. Pump              |
| 19. Elbow                              | 79. Tee               |
| 20. Hub                                | 80. Coupling Assembly |
| 21. Key                                | 81. Hub               |
| 22. Setscrew                           | 82. Elbow             |
| 23. Bolt                               | 83. Elbow             |
| 24. Elbow                              | 84. Lockwasher        |
| 25. Elbow                              | 85. Bolt              |
| 26. O-Ring                             | 86. Bolt              |
| 27. Flange Half                        | 87. Bolt              |
| 28. Flatwasher                         | 88. Flatwasher        |
| 29. Bolt                               | 89. Bolt              |
| 30. Pump                               | 90. Flatwasher        |
| 31. O-Ring                             | 91. Bar               |
| 32. Tee                                | 92. Manifold          |
| 33. Seal                               | 93. Lockwasher        |
| 34. Flange                             | 94. Pump              |
| 35. Capscrew                           | 95. Mount Structure   |
| 36. Adapter                            | 96. Bolt              |
| 37. Block                              | 97. Flatwasher        |
| 38. Capscrew                           | 98. Spacer            |
| 39. Bolt                               | 99. Flatwasher        |
| 40. Flange Half                        | 100. Flatwasher       |
| 41. Pump                               | 101. Bolt             |
| 42. Seal                               |                       |
| 43. Bolt                               |                       |
| 44. Tee                                |                       |
| 45. Test Block                         |                       |
| 46. Plug                               |                       |
| 47. Bolt                               |                       |
| 48. Adapter                            |                       |
| 49. Adapter Kit                        |                       |
| 50. Flange Structure                   |                       |
| 51. Flange Structure                   |                       |
| 52. Flatwasher                         |                       |
| 53. Bolt                               |                       |
| 54. Capscrew                           |                       |
| 55. Block                              |                       |
| 56. Coupling Assembly                  |                       |
| 57. Pump                               |                       |
| 58. O-Ring                             |                       |
| 59. Cover Plate                        |                       |
| 60. Capscrew                           |                       |

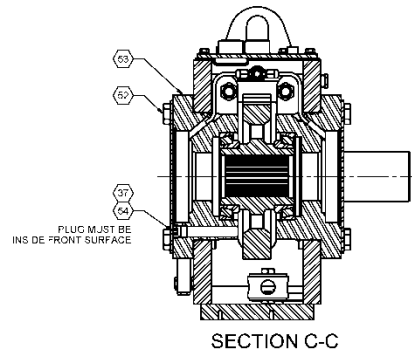
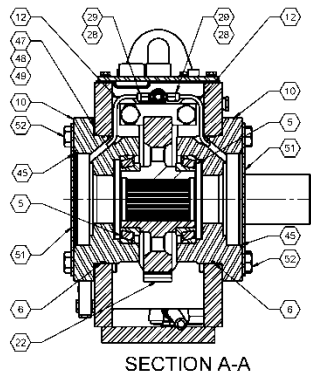
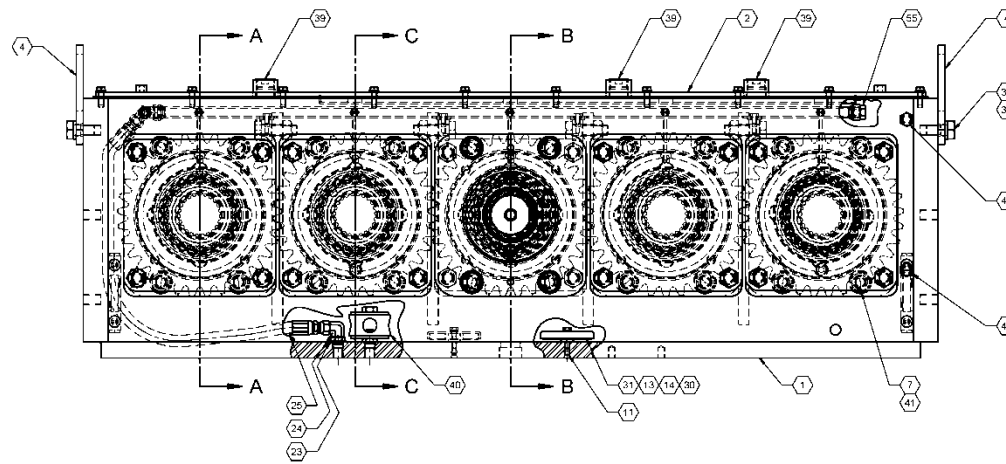
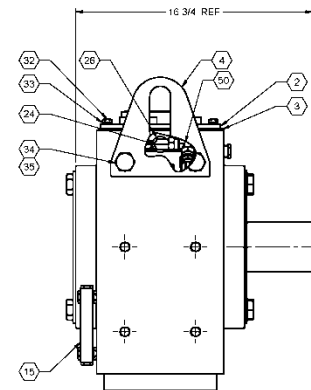
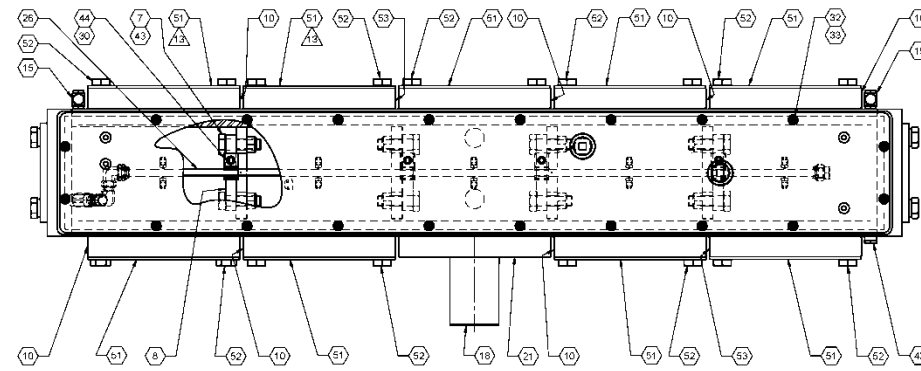
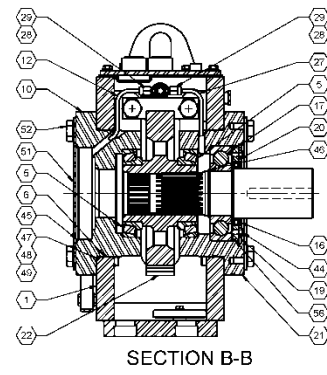
Figure 60. HPD gearbox and pumps Tier II (typical)



- |    |   |    |                   |
|----|---|----|-------------------|
| 1  | Gearbox and Drive Adapters Assembly (Page 2.9-2.9b) | 71 | Plug              |
| 2  | Air Compressor (Page 2.9-2.9d)                      | 72 | Elbow             |
| 3  | O-Ring  | 73 | Adapter           |
| 4  | Pump  | 74 | Lockwasher        |
| 5  | Lockwasher  | 75 | Bolt              |
| 6  | Bolt  | 76 | Pump Assembly     |
| 7  | Elbow   | 77 | O-Ring            |
| 8  | O-Ring  | 78 | Pump              |
| 9  | Test Block  | 79 | Tee               |
| 10 | Plug  | 80 | Coupling Assembly |
| 11 | Capscrew  | 81 | Adapter           |
| 12 | Flange Half   | 82 | Elbow             |
| 13 | Flatwasher  | 83 | Elbow             |
| 14 | Bolt  | 84 | Lockwasher        |
| 15 | Seal  | 85 | Bolt              |
| 16 | Flange Structure                                    | 86 | Block             |
| 17 | Lockwasher  | 87 | Capscrew          |
| 18 | Capscrew  | 88 | Flange Half       |
| 19 | Elbow   | 89 | Flatwasher        |
| 20 | Hub   | 90 | Bolt              |
| 21 | Key   | 91 | Flange Half       |
| 22 | Setscrew  | 92 | Bolt              |
| 23 | Flange Half   | 93 | Plug              |
| 24 | Bolt  | 94 | Spacer            |
| 25 | Flatwasher  | 95 | Flatwasher        |
| 26 | O-Ring  | 96 | Flatwasher        |
| 27 | Flatwasher  | 97 | Bolt              |
| 28 | Adapter Kit   |    |                   |
| 29 | Pump  |    |                   |
| 30 | O-Ring  |    |                   |
| 31 | Flange Structure                                    |    |                   |
| 32 | Bolt  |    |                   |
| 33 | Flatwasher  |    |                   |
| 34 | O-Ring  |    |                   |
| 35 | Capscrew  |    |                   |
| 36 | Adapter   |    |                   |
| 37 | Bolt  |    |                   |
| 38 | Flatwasher  |    |                   |
| 39 | Bar   |    |                   |
| 40 | Bolt  |    |                   |
| 41 | Flatwasher  |    |                   |
| 42 | Seal  |    |                   |
| 43 | Mount Structure                                     |    |                   |
| 44 | Pump  |    |                   |
| 45 | Test Block  |    |                   |
| 46 | Bolt  |    |                   |
| 47 | Manifold  |    |                   |
| 48 | Lockwasher  |    |                   |
| 49 | Bolt  |    |                   |
| 50 | Flange Structure                                    |    |                   |
| 51 | Adapter   |    |                   |
| 52 | Pump  |    |                   |
| 53 | Adapter Kit   |    |                   |
| 54 | Capscrew  |    |                   |
| 55 | Block   |    |                   |
| 56 | Coupling Assembly                                   |    |                   |
| 57 | Pump  |    |                   |
| 58 | O-Ring  |    |                   |
| 59 | Cover Plate   |    |                   |
| 60 | Capscrew  |    |                   |
| 61 | Plug  |    |                   |
| 62 | Flange Structure                                    |    |                   |
| 63 | O-Ring  |    |                   |
| 64 | Bolt  |    |                   |
| 65 | Test Block  |    |                   |
| 66 | Bolt  |    |                   |
| 67 | Bolt  |    |                   |
| 68 | Flatwasher  |    |                   |
| 69 | Flange Half   |    |                   |
| 70 | Test Block  |    |                   |

TA15781

Figure 61. HPD gearbox and pumps L2350 (typical)



- NOTES:
1. OIL CAPACITY 7 GAL APPROXIMATELY
  2. USE LOCTITE HYDRAULIC SEALANT ON ALL THREADED COMPONENTS
  3. TORQUE TEM 7 TO 250-280 FT.LB.
  4. DO NOT USE FUEL OIL FORD 9000 IN ASSEMBLY

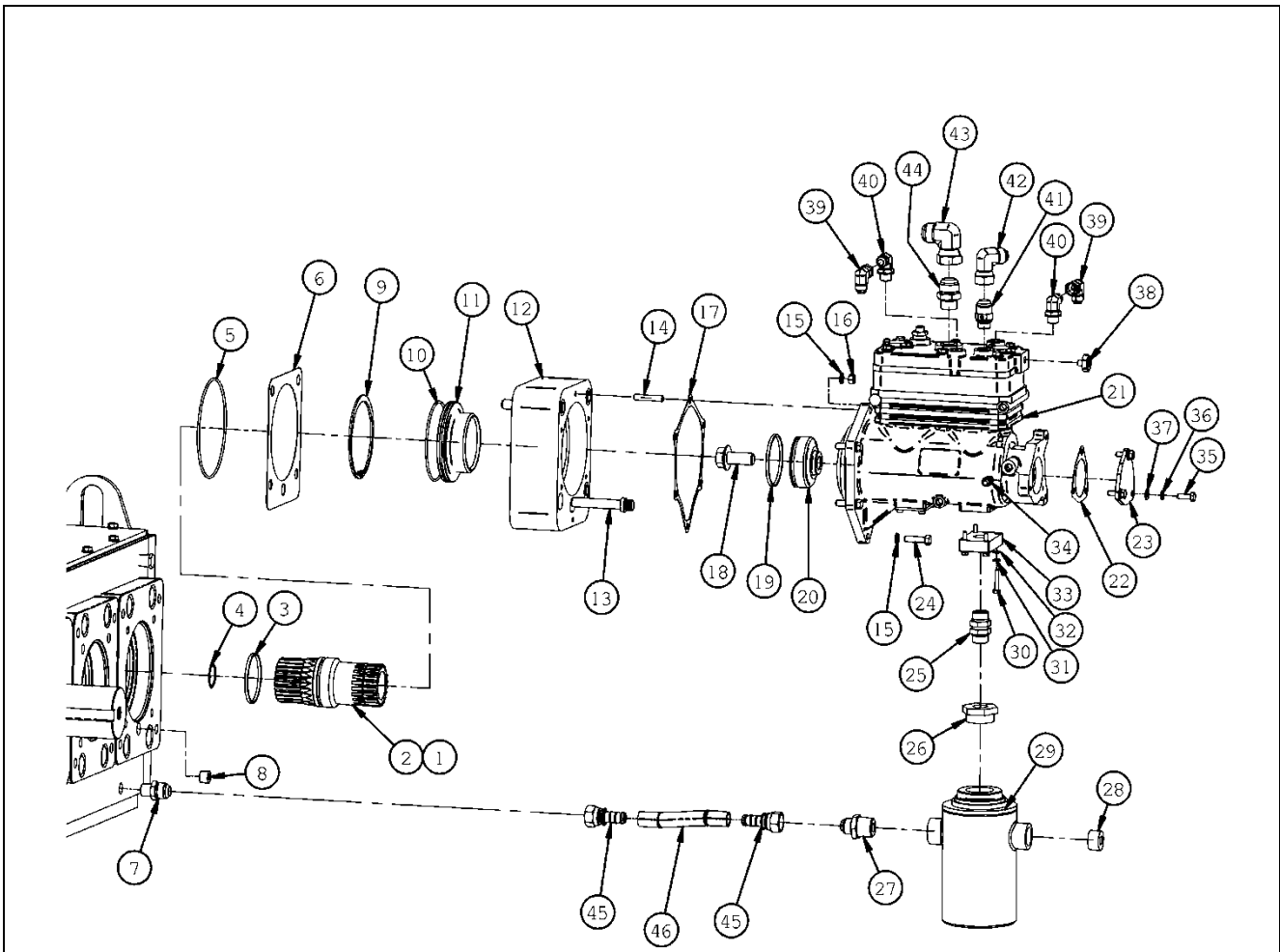
SOURCES:  
 MERIT GEAR CORP  
 CHICAGO GEAR

ITEM	PART NO.	QTY	DESCRIPTION
56	4281088	1	O-RING 139 0.23 900 VI 258
55	4020769	1	PLUG - 1/2
54	0194288	2	PIPE PLUG HEX
53	4234598	7	BRG HSG AIRCOMP
52	0021643	36	BOLT HX 3/4-10 UNCG x 1
51	4239284	8	PLATE COVER - F
50	4002478	1	HYD FITTING 90-DEG 8 MJ 8 FJ
49	4236583	AR	SHIM - 020
48	4236582	AR	SHIM - 010
47	4236581	AR	SHIM - 003
46	4177289	1	RETAINING RING EXT 2 500
45	4244531	9	O-RING 139 5 48 900 VI 280
44	0812262	6	BOLT HX 3/16 500 NC GB FT
43	4090295	8	LOCKNUT (ALL METAL) FINISHED HEXAGON
42	4223398	2	PIPE PLUG 500 OH HEX
41	4148687	40	WASHER FLAT B13.1 488 217
40	4161004	1	DIFFUSER
39	4013908	3	PIPE PLUG 1.00 CS 50 MAGNETIC
38	0458095	AR	PRIMER "LOCK QUICK" GRADE"
37	4109728	AR	SEA. ANT. HYD. LOCTITE #589-31
35	0021542	4	WASHER LOCK SPR 750 1.27 19
34	4099623	4	BOLT HX 750 1.50 NC GB
33	0753123	20	WASHER LOCK SPR 375 68 09
32	0810971	20	BOLT HX 375 1.00 NC GB FT
31	4103883	2	MAGNET CLIP ASSEMBLY
30	0264174	8	WASHER LOCK SPR 323 59 08
29	4102207	10	TUBE NUT 1/4
28	4102209	10	TUBE FERRULE - 1/4" TUBE
27	4219856	1	TUBE GEAR BOX
26	4219857	1	STR MANIFOLD TUBE
25	4082859	1	HOSE-A 8-26 O.J. 2000PSI
24	4002471	2	FTG HYD 90 8 MJ 8 MO
23	4161011	1	WASHER FLAT 790 1.13 06 CP
22	4236588	5	GEAR HPD
21	4236585	1	BEARING HOUSING INPUT
20	4215395	1	PL SEAL INPUT SHAFT
19	4177299	1	RETAINING RING # N5000-675
18	4219848	1	SHAFT INPUT
17	4177282	1	BALL BEARING
16	4177295	1	OIL SEAL 3 500 ID X 4 500 OD
15	4130648	2	LIQUID LEVEL GAUGE
14	0824753	2	BOLT HX 3/16 250 NC GB FT
13	4005904	2	BOLT BLOCK 875 625 3/8-16 THD
12	4237502	9	TUBE GEAR BOX
11	0186425	2	SCSR 313 500 NC CLIP
10	4236586	7	BEARING HOUSING OUTPUT
8	4219851	4	BRACE BAR
7	0021648	48	BOLT HX 750 2 50 NC GR8
6	4237587	10	O-RING 285 VITON
5	4177281	10	TAPERED ROLLER BEARING ASSY
4	4103073	2	PL EYE
3	4182926	1	COVER GASKET
2	4254480	1	STR COVER PLATE
1	4236581	1	GEARBOX HOUSING MACHINED

PROPERTY OF LE TOURNEAU TECHNOLOGIES  
 UNLESS OTHERWISE SPECIFIED  
 ALL DIMENSIONS ARE IN INCHES  
 UNLESS OTHERWISE SPECIFIED  
 FINISHES ARE AS SHOWN  
 FIRST USED: 01/01/2013  
 423-6590  
**LeTourneau Technologies™**

Figure 62. HPD gearbox assembly L1350/L1850/L2350 (typical)

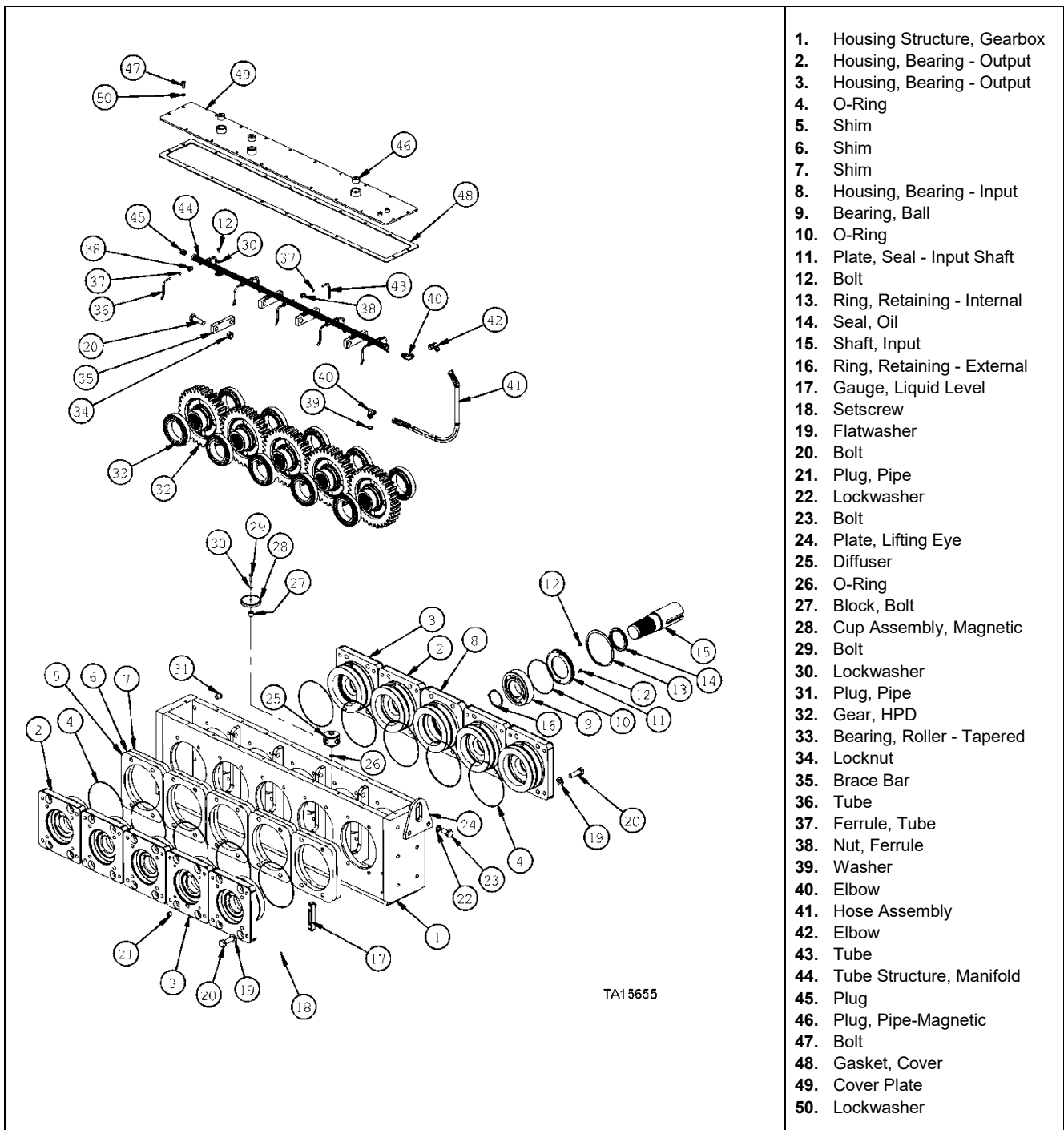
This Page Intentionally Left Blank



TA15664

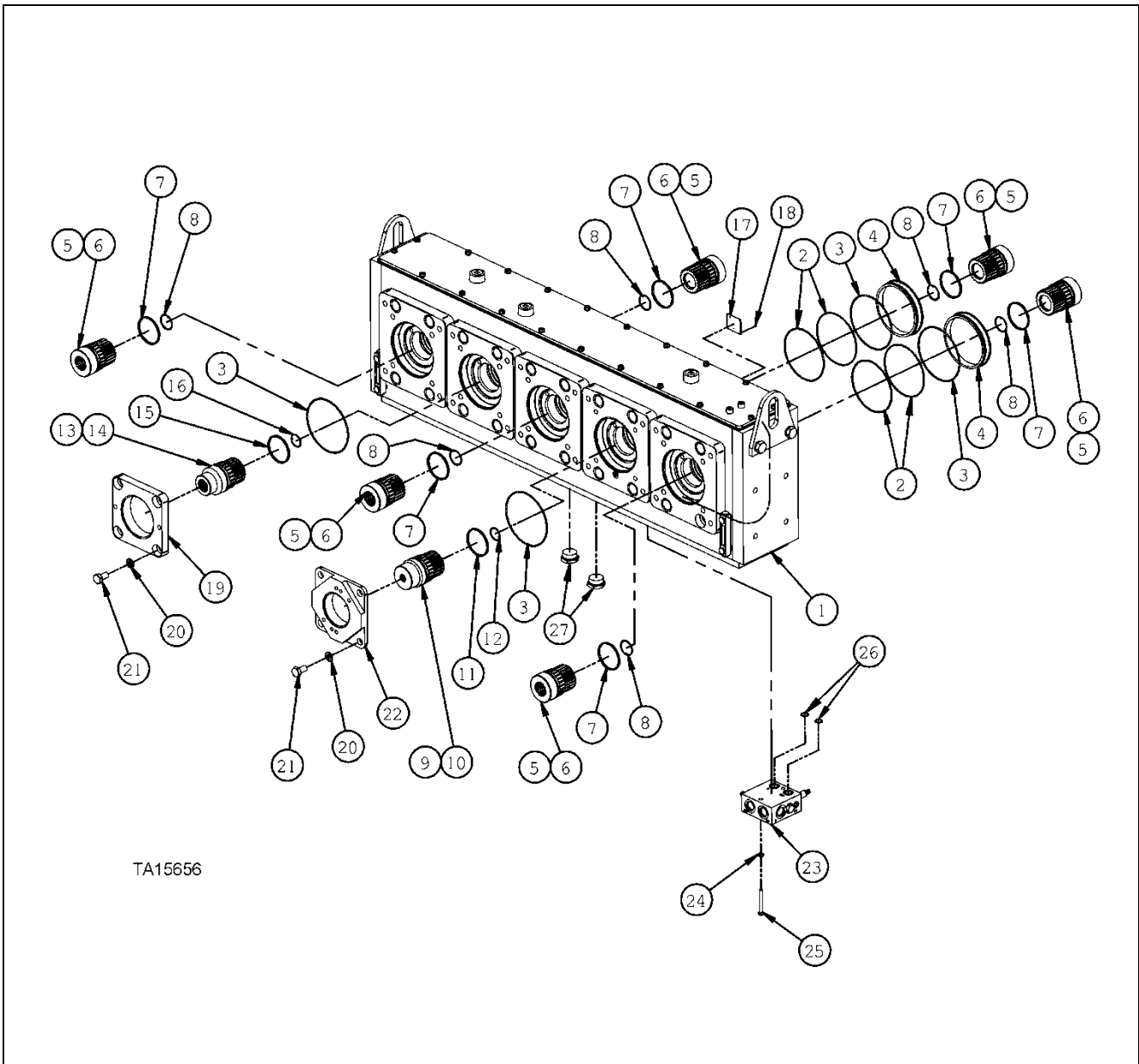
<ul style="list-style-type: none"> <li>1. Adapter Sleeve Assembly</li> <li>2. Adapter Sleeve</li> <li>3. Ring, Piston</li> <li>4. Retaining Ring</li> <li>5. O-Ring</li> <li>6. Gasket, Compressor Adapter</li> <li>7. Adapter</li> <li>8. Plug, Pipe</li> <li>9. Ring, Retainer - Internal</li> <li>10. O-Ring</li> <li>11. Adapter, Seal</li> <li>12. Mount Adapter, Compressor</li> <li>13. Capscrew</li> <li>14. Stud</li> <li>15. Lockwasher</li> <li>16. Nut</li> <li>17. Gasket</li> </ul>	<ul style="list-style-type: none"> <li>18. Bolt</li> <li>19. Ring, Piston</li> <li>20. Hub, Drive</li> <li>21. Compressor, Air</li> <li>22. Gasket, Cover</li> <li>23. Cover</li> <li>24. Bolt</li> <li>25. Adapter</li> <li>27. Adapter</li> <li>28. Plug, Pipe-Magnetic</li> <li>29. Filter Assembly, Suction</li> <li>30. Bolt</li> <li>31. Lockwasher</li> <li>32. Flatwasher, #12 – Special</li> <li>33. Cover, Crankcase Drain</li> <li>34. Adapter</li> </ul>	<ul style="list-style-type: none"> <li>35. Bolt</li> <li>36. Lockwasher</li> <li>37. Flatwasher</li> <li>38. Valve Assembly, Check- Exhaust</li> <li>39. Elbow, Swivel</li> <li>40. Elbow</li> <li>41. Adapter</li> <li>42. Elbow, Swivel</li> <li>43. Elbow, Swivel</li> <li>44. Adapter</li> <li>45. Adapter</li> <li>46. Hose</li> </ul>
---	--	---

Figure 63. HPD mounted air compressor L1350/L1850/L2350 (typical)



- 1. Housing Structure, Gearbox
- 2. Housing, Bearing - Output
- 3. Housing, Bearing - Output
- 4. O-Ring
- 5. Shim
- 6. Shim
- 7. Shim
- 8. Housing, Bearing - Input
- 9. Bearing, Ball
- 10. O-Ring
- 11. Plate, Seal - Input Shaft
- 12. Bolt
- 13. Ring, Retaining - Internal
- 14. Seal, Oil
- 15. Shaft, Input
- 16. Ring, Retaining - External
- 17. Gauge, Liquid Level
- 18. Setscrew
- 19. Flatwasher
- 20. Bolt
- 21. Plug, Pipe
- 22. Lockwasher
- 23. Bolt
- 24. Plate, Lifting Eye
- 25. Diffuser
- 26. O-Ring
- 27. Block, Bolt
- 28. Cup Assembly, Magnetic
- 29. Bolt
- 30. Lockwasher
- 31. Plug, Pipe
- 32. Gear, HPD
- 33. Bearing, Roller - Tapered
- 34. Locknut
- 35. Brace Bar
- 36. Tube
- 37. Ferrule, Tube
- 38. Nut, Ferrule
- 39. Washer
- 40. Elbow
- 41. Hose Assembly
- 42. Elbow
- 43. Tube
- 44. Tube Structure, Manifold
- 45. Plug
- 46. Plug, Pipe-Magnetic
- 47. Bolt
- 48. Gasket, Cover
- 49. Cover Plate
- 50. Lockwasher

Figure 64. HPD assembly view L1350/L1850/L2350 (typical)



TA15656

<ul style="list-style-type: none"> <li>1. Gearbox Assembly</li> <li>2. O-Ring</li> <li>3. O-Ring</li> <li>4. Adapter Sleeve</li> <li>5. Adapter Sleeve</li> <li>6. Adapter Sleeve</li> <li>7. Ring</li> <li>8. Retaining Ring</li> <li>9. Adapter Sleeve</li> </ul>	<ul style="list-style-type: none"> <li>10. Adapter Sleeve</li> <li>11. Ring</li> <li>12. Retaining Ring</li> <li>13. Adapter</li> <li>14. Adapter</li> <li>15. Ring</li> <li>16. Retaining Ring</li> <li>17. Data Plate</li> <li>18. Screw</li> </ul>	<ul style="list-style-type: none"> <li>19. Adapter Plate</li> <li>20. Lockwasher</li> <li>21. Bolt</li> <li>22. Adapter Mount</li> <li>23. Valve Assembly</li> <li>24. Lockwasher</li> <li>25. Bolt</li> <li>26. O-Ring</li> <li>27. Plug</li> </ul>
---	---	--

Figure 65. HPD and drive adapters L1850/L2350 (typical)

This Page Intentionally Left Blank

# Capscrew and Bolt-Nut Torque Specifications

There are some exceptions to the torques provided on the following pages. Reduced torques are specified in the planetary drive rebuild manual, for the capscrews holding the planetary drive covers, due to a copper sealing washer under the head of the capscrew.

The torque specifications on this chart apply only to Grade 8 bolts, black or gold colored, and 12PT black-colored alloy steel capscrews. 12PT capscrews with gold-colored zinc chromate plating are excluded from these specifications and the zinc chromate 12PT capscrews should not be used on loaders or dozers. (except for planetary drive covers)

These torque values are for normal routine operations. If doing component rebuilds or any other abnormal machine component assembly/disassembly, please contact the factory for these values for specific instances.

 <p style="text-align: right; font-size: small;">TA15358A</p>	 <p style="text-align: right; font-size: small;">TA15358B</p>	 <p style="text-align: right; font-size: small;">TA15356-1</p>
<p style="text-align: center;">Does not apply <b>X</b></p>	<p style="text-align: center;">12PT Alloy Capscrew <b>✓</b></p>	<p style="text-align: center;">Grade 8 Bolt <b>✓</b></p>

## NOTICE

**Please note the additional tables for exceptions to the torque values for items such as Lift Arm Ballcaps, Super Nuts and steering pin bolts with drilled grease passages.**

Please direct any questions to Komatsu Product Support.

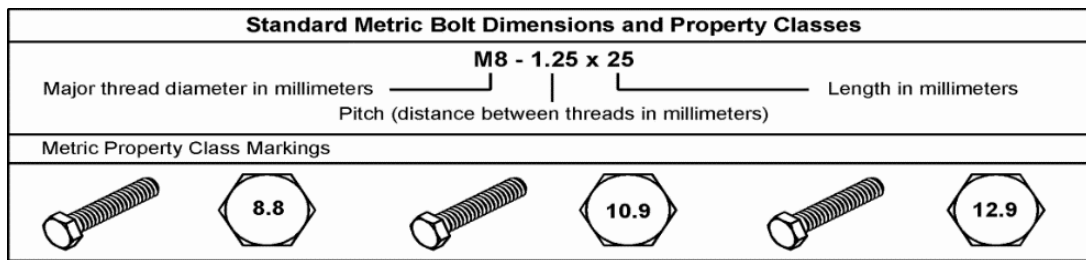
Capscrew and Bolt-Nut Torque Specifications Chart

**Standard SAE G8 and Alloy Steel and Hex Socket Capscrews**

Size	Thread	GRADE 8 Fasteners		Alloy Steel 12PT. and Hex Socket Capscrews	
		USA Units lb-ft	Metric Units N-m	USA Units lb-ft	Metric Units N-m
		**Lubed	**Lubed	**Lubed	**Lubed
1/4 (0.25)	20 UNC	9	13	12	16
	28 UNF	10	14	14	19
5/16 (0.3125)	18 UNC	18	25	24	33
	24 UNF	20	27	27	37
3/8 (0.375)	16 UNC	33	45	45	61
	24 UNF	37	50	50	68
7/16 (0.4375) (* See Note below)	14 UNC	52	71	70	95
	20 UNF	58	79	79	107
1/2 (0.5) (* See Note below)	13 UNC	80	109	108	146
	20 UNF	90	122	122	165
5/8 (0.625)	11 UNC	159	216	203	275
	18 UNF	180	244	230	312
3/4 (0.75)	10 UNC	282	383	361	490
	16 UNF	315	427	403	546
1 (1.0) (*** See Note below)	8 UNC	682	925	872	1182
	14 UNS	764	1,036	977	1325
1-1/8 (1.125)	7 UNC	966	1310	1235	1674
	12 UNF	1083	1468	1385	1878
1-1/4 (1.25) (**** See Note below)	7 UNC	1,363	1,848	1744	2365
	12 UNF	1,509	2,046	1930	2617
1-1/2 (1.5)	6 UNC	2,371	3,215	3033	4113
	12 UNF	2,668	3,618	3413	4628
* See Special Torque Specifications for ROPS super nut.		*** This bolt is UNS (with 14 threads per inch), it is NOT UNF. It is a unique thread count bolt.			
** See page 4 for specifications for "LUBED" – engine oil on threads and shoulder.		**** See Special Torque Specifications for loader lift arms and 1350/1850/2350 steering pins.			
*** See Special Torque Specifications for 950/1150 steering pins.					

## Standard Metric Bolts and Grades (SAE J1701M)

Size (mm)	Pitch (mm)	Property Class 8.8		Property Class 10.9		Property Class 12.9	
		USA Units lb-ft	Metric Units N-m	USA Units lb-ft	Metric Units N-m	USA Units lb-ft	Metric Units N-m
		** Lubed	** Lubed	** Lubed	** Lubed	** Lubed	** Lubed
6	1.00	6	8	8	11	10	13
7	1.00	10	13	14	19	16	22
8	1.25	14	19	20	27	24	32
10	1.50	28	38	40	54	47	63
12	1.75	49	66	70	94	81	110
14	2.00	77	105	111	150	130	176
16	2.00	121	164	173	235	202	274
18	2.50	167	226	239	324	279	378
20	2.50	244	331	337	458	394	535
24	3.00	422	572	584	791	682	925



TA14554C

Capscrew and Bolt-Nut Torque Specifications

### Special Torque Specifications

#### Alloy Steel 12PT. Capscrew for Wheel Loader Lift Arm Ballcaps

Size	Type	Thread	USA Units	Metric Units	Application
			lb-ft	N-m	
			<b>**Lubed</b>	<b>**Lubed</b>	
1-1/4 (1.250)	12PT. capscrew F-C on head	7 UNC	1900	2577	LHD, L-950, L-1150, L-1350, L-1850, and L-2350 (Lift arm ball caps only)
1-1/4 (1.250)	12PT. capscrew B-7 on head	12 UNF	1320	1790	L-1000-L-1100 (Lift arm ball caps only)

#### Steering Pins (Hex Head Bolt)

Size	Type	Thread	USA Units	Metric Lubed	Application
			lb-ft	N-m	
			<b>** Lubed</b>	<b>** Lubed</b>	
1 (1.0)	Bolt (drilled center)	8UNC	425	576	LHD, L-950, D-950, L-1150 (Steering Pins)
1-1/4 (1.250)	Bolt (drilled center)	7UNC	850	1152	L-1350, L-1850, L-2350 (Steering Pins)

#### Aluminum 12pt. Capscrews used for Motor Pinion Balancing

Size	Type	Thread	USA Units (lb-ft)		Metric Units (N-m)	
			Dry	**Lubed	Dry	**Lubed
3/4 (0.75)	Aluminum	16 UNF	114	86	155	117
3/4 (0.75)	Aluminum 2024-T4	16 UNF	150	113	203	153
15/16 (.9375)	Aluminum 6061 T6	12 NF	217	163	294	221
15/16 (.9375)	Aluminum 2024-T4	12 NF (2 START)	285	214	387	290

#### 2-Thread (2-Start) Steel 12PT. Capscrews

Size	Type	Thread	USA Units	Metric Units
			lb-ft	N-m
			<b>** Lubed</b>	<b>** Lubed</b>
3/8 (.3750)	12PT.	24 NF	25	34
9/16 (.5625)	12PT.	18 NF	87	119
15/16 (.9375)	12PT.	14 NF	428	584
1-5/16 (1.325)	12PT.	12 NF	1216	1660

#### Bolt and Capscrew Markings on Head

<p><b>GRADE 5 BOLTS &amp; CAPSCREWS</b> (**TORQUE TO 70% OF GRADE 8 VALUES)</p> <p>NOTCH ON GRADE 5 12 POINT CAPSCREW HEAD</p> <p>TAPER HEAD - OR - FLAT HEAD</p> <p>(OLD LeTourneau manufactured capscrews)</p> <p>TA11165G</p>	<p><b>GRADE 8 MARKINGS ON BOLT HEAD</b></p> <p>TA11165E</p>	<p>12 PT ALLOY CAPSCREW</p> <p>HEX SOCKET HEAD CAPSCREW</p> <p>TA11165H</p>
--	---	---

#### Typical Markings on Alloy Capscrew Heads

#### Typical B-7, 2-Start

<p>ALL PRO    FERRY    DARLING    CARDINAL    SOCKET HEAD</p> <p>TA11165I</p>	<p>B-7</p> <p>TA11165J</p>	<p>KNURL ON FLAT FOR 2-START</p>
---	----------------------------	----------------------------------

\*\* See "Key Items" for specifications for "LUBED" – engine oil on threads and shoulder.

## Capscrew and Bolt-Nut Torque Specifications

### Key Items

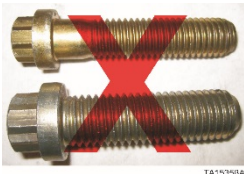
- “LUBED” is defined as having the threads and under the head lubricated with engine oil. Engine oil is defined as SAE 30 or 40 weight oil, including multi viscosity grades 5W-30 through 15W-40. No other lubricant (such as anti-seize, MolyKote, copper coat, grease, etc.) is permitted unless specifically called out in a Komatsu procedure.

**\*\*LUBED = Lubricated with engine oil on threads and under head**  
(SAE 30 or 40 weight oil, including multi viscosity grades 5W-30 through 15W-40)

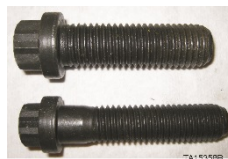


**NOTE:** No other lubricant (such as anti-seize, never seize, MolyKote, copper coat, grease, etc.) is permitted unless specifically called out in a Komatsu procedure.

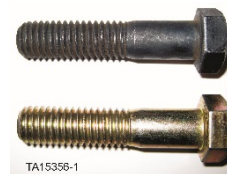
- All capscrews and bolts should be started by hand until a minimum of three (3) threads are engaged prior to any air impact equipment being used.
- If a procedure in a Rebuild Manual, Repair and Overhaul or Operating and Service Manual calls for the use of Loctite® threadlocker on the threads, the torque specification for “lubed” should be used. The threads on both the fastener and mating part should be thoroughly cleaned with a proper solvent prior to use of Loctite®. The Loctite® thread sealant should only be used on the threads - not the head.
- Certain applications in components such as drivers or lift arm ball caps may specify a FERRY brand of capscrew. Use only FERRY brand capscrews in these applications.
- Komatsu, recommends that any old 12PT. Komatsu-fabricated (fabrication was stopped many years ago) capscrew (refer to illustration under BOLT AND CAPSCREW MARKINGS ON HEAD) be replaced at the time of repair with alloy capscrews. If new capscrews are not available, then the Komatsu-fabricated capscrews should only be torqued to Grade 5 specifications (70% of Grade 8 value - lubed).
- The torque specifications on the charts on page 2 only apply to Grade 8 bolts, metric bolts and 12PT. black-colored alloy steel capscrews. Capscrews with gold-colored zinc chromate plating are excluded from these specifications and these capscrews should not be used on loaders or dozers except for driver covers.



Does not apply **X**

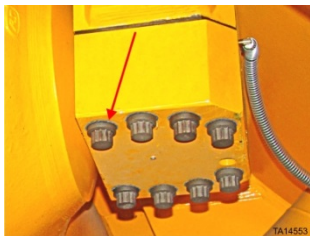


12PT Alloy Capscrew **✓**



Grade 8 Bolt **✓**

- **CLEANING:** It is mandatory to remove all paint, rust and debris from all mating surfaces, surfaces under the head of the bolt or capscrew and threads prior to installation and torquing of all bolts and capscrews.



Arrow indicates location to be cleaned



Cleaning paint and rust prior to torquing

This Page Intentionally Left Blank